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# FCC and ISED Test Report for Parts 15.107, 15.109, 15.209, 15.247, RSS-GEN and RSS-247

| | |
|---|---|
| Main type designation | : Easycontrol White, CT200 |
| Applicant | : Bosch Thermotechnik GmbH |
| FCC ID | : 2AODDCT200 |
| ISED ID | : 23386-CT200 |

Test report No. : 170601858 04 Ver 2.00

# Laboratory information

## Accreditation

Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Designation number is: NL0001

The Industry Canada registration number for the 3 meter test chamber of Telefication is: 4173A-1.

## Documentation

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2005. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at Telefication Netherlands

## Testing Location

| | |
|---|---|
| **Test Site** | Telefication BV |
| **Test Site location** | Edisonstraat 12a<br>6902 PK Zevenaar<br>The Netherlands<br><br>Tel. +31889983600<br>Fax. +31316583189 |
| **Test Site FCC** | NL0001 |

## Revision History

| Version | Date | Remarks | By |
|---|---|---|---|
| v0.50 | 1-09-2017 | First draft | RvB |
| v1.00 | 27-11-2017 | Release version | RvB |
| v2.00 | 16-02-2018 | Release version | RvB |

# Table of Contents

## Summary of Test results

| FCC | IC | Description | Section in report | Verdict |
|---|---|---|---|---|
| 15.247(a) | RSS-247 5.2 (1) | 6dB Bandwidth | 3.1 | Pass |
| -- | RSS-GEN 6.6 | 99% Bandwidth | 3.2 | Pass |
| 15.247(b) | RSS-247 5.1 (2) | RF output power | 3.3 | Pass |
| 15.247(e) | RSS-247 5.2 (2) | Power spectral density | 3.4 | Pass |
| 15.247(d) | RSS-247 5.5 | Conducted Spurious emissions | 3.5 | Pass |
| 15.107 (a) | RSS-GEN | Conducted limits | 3.7 | Pass |
| 15.109 (a) | RSS-GEN | Radiated emission limits | 3.6 | Pass |
| 15.209 (a) | RSS-247 5.4 | Radiated Spurious emissions | 3.6 | Pass |
| 15.205 (a) | RSS Gen 8.10 | Spurious emissions in the restricted bands | 3.6 | Pass |

# 1 General Description

## 1.1 Applicant

| | |
|---|---|
| **Client name:** | Bosch Thermotechnik GmbH |
| **Address** | Junkersstrasse 20-24 |
| **Zip code:** | D-73249 Wernau, Germany |
| **Contact name:** | Andreas Kirchner-Gellert |
| **E-mail:** | Andreas.Kirchner-Gellert@de.bosch.com |

## 1.2 Manufacturer

| | |
|---|---|
| **Manufacturer name:** | Bosch Thermotechnik GmbH |
| **Address:** | Junkersstrasse 20-24 |
| **Zip code:** | D-73249 Wernau, Germany |
| **Contact name:** | Andreas Kirchner-Gellert |
| **E-mail:** | Andreas.Kirchner-Gellert@de.bosch.com |

## 1.3 Tested Equipment Under Test (EUT)

| | |
|---|---|
| **Product description:** | Control device |
| **Main trademark:** | Bosch |
| **Main type designation:** | Easycontrol White, CT200 |
| **FCC ID:** | 2AODDCT200 |
| **ISED ID** | 23386-CT200 |
| **Variant:** | Easycontrol Black, CT200B |
| **Software version:** | RRCNG 00.08.01 |
| **Hardware version:** | 9 |
| **Date of receipt** | 25-07-2017 |
| **Tests started:** | 25-07-2017 |
| **Testing ended:** | 16-02-2018 |

## 1.4 Product specifications of Equipment under test

| | |
|---|---|
| **TX Frequency range (MHz):** | WLAN (802.11b/g): 2400 – 2472<br>IEEE 802.15.4: 2400 – 2480 |
| **Rx frequency range (MHz):** | WLAN (802.11b/g): 2400 – 2472<br>IEEE 802.15.4: 2400 - 2480 |
| **Maximum output power to antenna (dBm):** | IEEE 802.11b: 13.8<br>IEEE 802.11g: 10.9<br>IEEE 802.15.4: 11.4 |
| **Antenna type :** | WLAN (802.11b/g): PCB antenna<br>IEEE 802.15.4: PCB antenna |
| **Antenna gain (dBi):** | WLAN (802.11b/g): 3.2<br>IEEE 802.15.4: 3.2 |
| **Type of modulation:** | WLAN: Acc. to IEEE 802.11 b/g<br>acc. to IEEE 802.15.4 |
| **Emission designator 802.11b:** | 16M6G1D |
| **Emission designator 802.11g:** | 14M6G1D |
| **Emission designator 802.15.4:** | 2M58G1D |

## 1.5 Modification of the Equipment Under Test (EUT)

None.

## 1.6 Observations and remarks

The EUT has two radios embedded, an Wlan radio and anIEEE 802.15.4. This report covers the Wlan and IEEE 802.15.4 radios.

## 1.7 Environmental conditions

| | | | |
|---|---|---|---|
| **Test date** | 25-07-2017 | 30-08-2017 | 16-02-2018 |
| **Ambient temperature** | 24.8 °C | 24.8 °C | 20.0 °C |
| **Humidity** | 53.2 % | 57.3 % | 33.2 % |

## 1.8 Measurement Standards

- FCC KDB Publication No. 558074 D01DTS Meas. Guidance V03r05
- ANSI C63.10:2013

## 1.9 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart B §15.107, §15.109
- FCC Part 15 Subpart C §15.247, §15.207
- RSS-247 Issue 1, RSS-GEN Issue 4

## 1.10 Conclusions

The sample of the product showed **NO NON-COMPLIANCES** to the specifications stated in paragraph 1.9 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Telefication accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.9 *"Applicable standards".*

All tests are performed by:

Name : ing. R. van Barneveld

Review of test methods and report by:

Name : ing P.A. Suringa

The above conclusions have been verified by the following signatory:

Date : 16-02-2018

Name : ing. K.A. Roes

Function : Coordinator Radio Laboratory

Signature :

# 2 Test configuration of the Equipment Under Test

## 2.1 Test mode

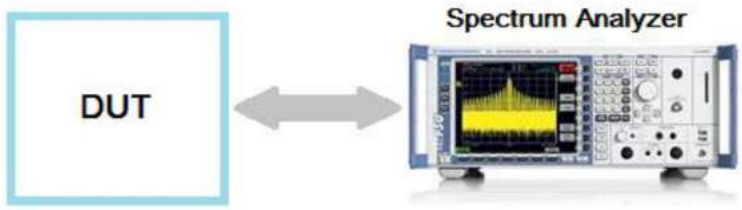
The applicant provided test mode firmware for the EUT, in which it was possible to configure the EUT into different test channels.

## 2.2 Tested channels and Data rates

| Technology | Channels | Data rate | Frequency (MHz) |
|---|---|---|---|
| IEEE 802.11b | 1 | 11 Mbps | 2412 |
| | 6 | 11 Mbps | 2437 |
| | 11 | 11 Mbps | 2462 |
| IEEE 802.11g | 1 | 54 Mbps | 2412 |
| | 6 | 54 Mbps | 2437 |
| | 11 | 54 Mbps | 2462 |
| IEEE 802.15.4 | 11 | 250 kbps | 2405 |
| | 19 | 250 kbps | 2445 |
| | 26 | 250 kbps | 2480 |

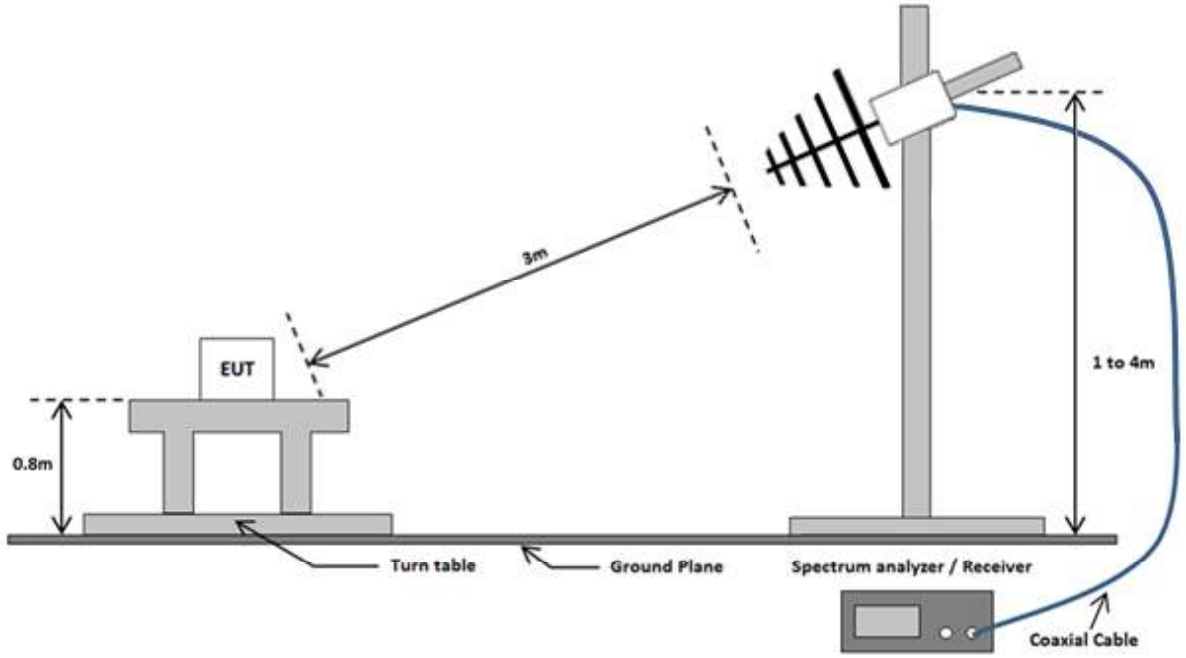
## 2.3 Conducted Test setup

*RF tests at antenna connector*

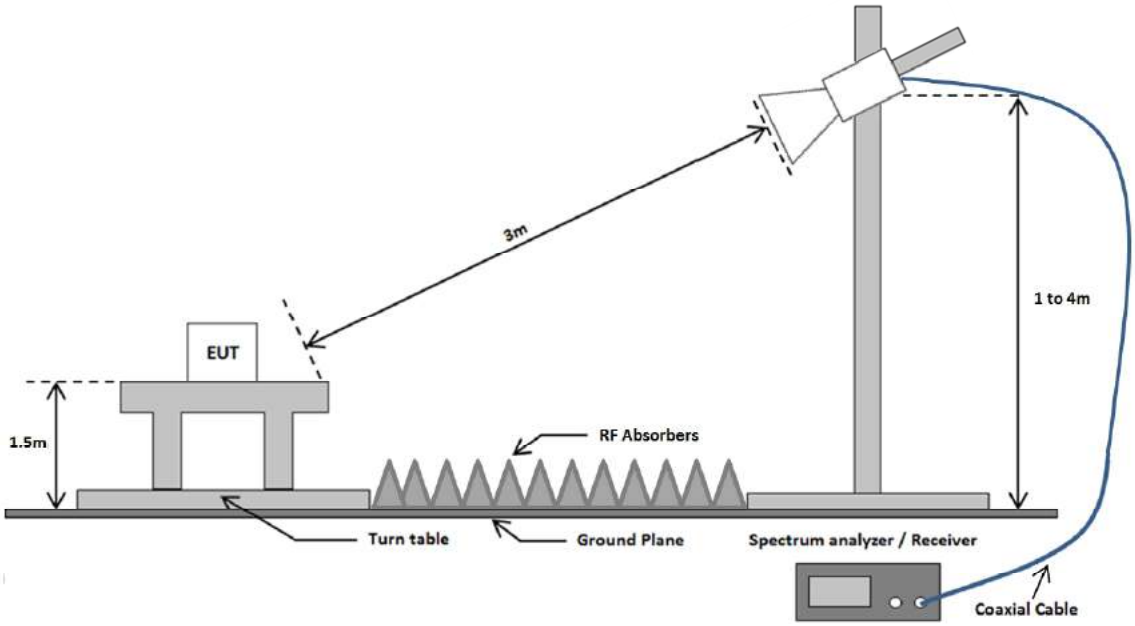


## 2.4 Radiated Test setup

**Radiated emissions test setup 30 MHz - 1 GHz**




**Radiated emissions test setup above 1 GHz**



## 2.5 Equipment used in the test configuration

| Description | Manufacturer | Model | ID | Used at Par. |
|---|---|---|---|---|
| Signal Generator | Hewlett Packard | 83650B | TE00487 | 3.1 to 3.5 |
| Spectrum Analyzer | Rohde & Schwarz | FSV | TE01269 | 3.1 to 3.5 |
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | TE11125 | 3.6 |
| Spectrum Analyzer | Rohde & Schwarz | ESR7 | TE01220 | 3.6, 3.7 |
| 10 MHz distribution Amplifier | Stanford Research Systems | FS735/1 | TE01278 | 3.1 to 3.5 |
| USB to GPIB adapter | National Instruments | GPIB-USB-HS+ | TE01283 | 3.1 to 3.5 |
| Biconilog Antenna | Chase | CBL6112A | TE00967 | 3.6 |
| Horn Antenna | EMCO The Electro – Mechanics Co | 3115 | TE00531 | 3.6 |
| SAC Chamber | Comtest Engineering BV | - | TE00861 | 3.6 |
| Pre-amplifier | Miteq | AFS42-041001800-29-OP-42 | TE11132 | 3.6 |
| Pre-amplifier | Miteq | JS4-18004000-30-8P-A1 | TE11131 | 3.6 |
| High pass filter | Wainwright instruments | WHK3.0/18G-10EF | TE01140 | 3.6 |
| Horn antenna | Flann Microwave | 20240-25 | TE00818 | 3.6 |
| Measurement software | DARE!! | RadiMation® Ver. 2016 | -- | 3.6 – 3.7 |

## 2.6 Explanation of the Measurement results for all conducted test items

The path loss between the EUT and the spectrum analyser for the frequency range of 30 MHz to 40 GHz has been measured and stored in the transducer table of the spectrum analyser. This transducer table is used for level offset of the spectrum analyser. With this level offset the spectrum analysers reading will be exactly the RF output.

## 2.7 Sample calculation

Field Strength Measurement example:

| Frequency (GHz) | Polarization | Height(m) | Peak (dBµV/m) |
|---|---|---|---|
| 7,236 | Horizontal | 2 | 52.5 |

The following relation applies:

E (dBµV/m) = U(dBµV) + AF (dB/m) – G (dB) + CL (dB)

Where:

E = Electric field strength
U = Measuring receiver voltage
AF = Antenna factor
G = Gain of the pre-amplifier
CL = Cable loss

(52.5 = 48.12 + 36.1 - 37.42 + 5.7)

# 3 Test results

## 3.1 6dB bandwidth Measurement

### 3.1.1 Limit

The minimum 6 dB Bandwidth shall be at least 500 kHz.

### 3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

### 3.1.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

### 3.1.4 Test procedure

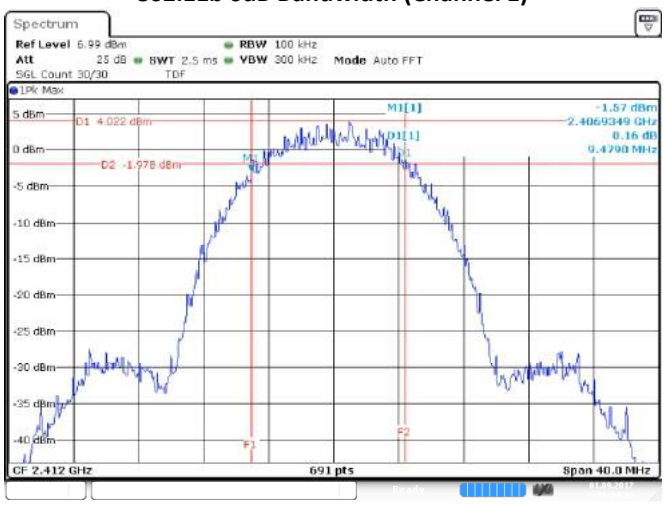
The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.

### 3.1.5 Test Results of the 6 dB bandwidth Measurement

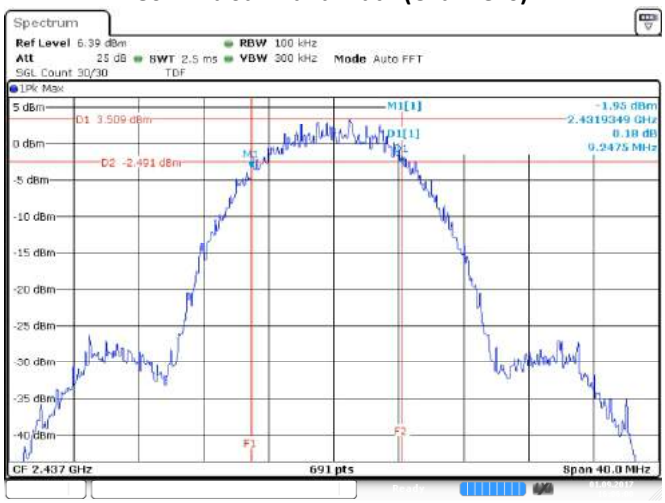
| Technology Std. | Channel | Frequency (MHz) | Data rate | 6dB bandwidth (MHz) |
|---|---|---|---|---|
| IEEE 802.11b | 1 | 2412 | 11 Mbps | 9.479 |
| | 6 | 2437 | 11 Mbps | 9.247 |
| | 11 | 2462 | 11 Mbps | 9.247 |
| IEEE 802.11g | 1 | 2412 | 54 Mbps | 16.396 |
| | 6 | 2437 | 54 Mbps | 16.396 |
| | 11 | 2462 | 54 Mbps | 16.396 |
| IEEE 802.15.4 | 11 | 2405 | 250 kbps | 1.630 |
| | 19 | 2445 | 250 kbps | 1.599 |
| | 26 | 2480 | 250 kbps | 1.646 |
| Uncertainty | ± 362 kHz | | | |

### 3.1.6 Plots of the 6 dB bandwidth Measurement

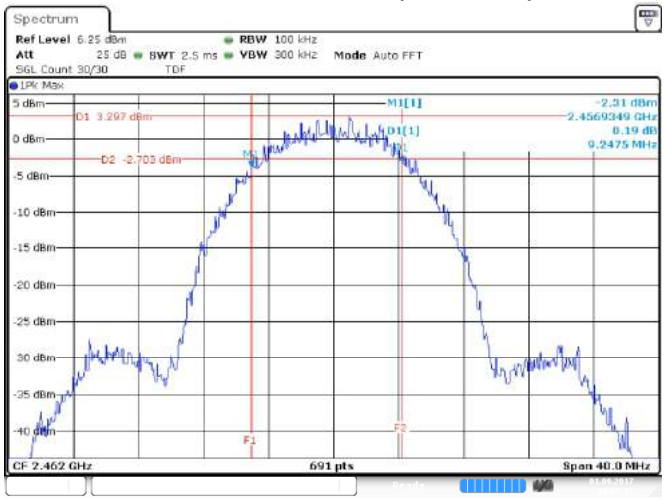
**802.11b 6dB Bandwidth (Channel 1)**



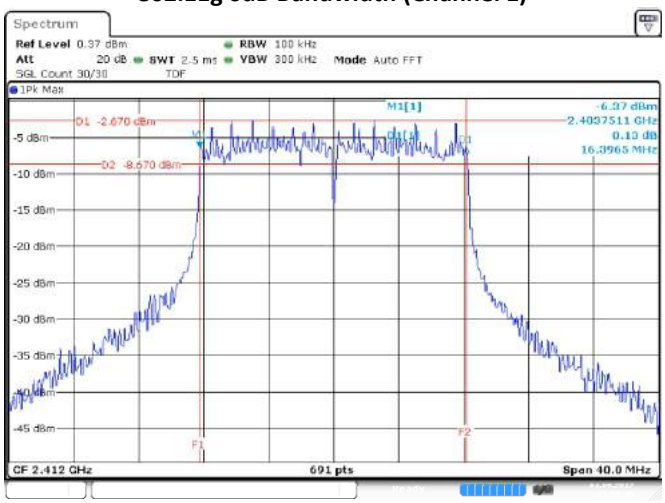

**802.11b 6dB Bandwidth (Channel 6)**



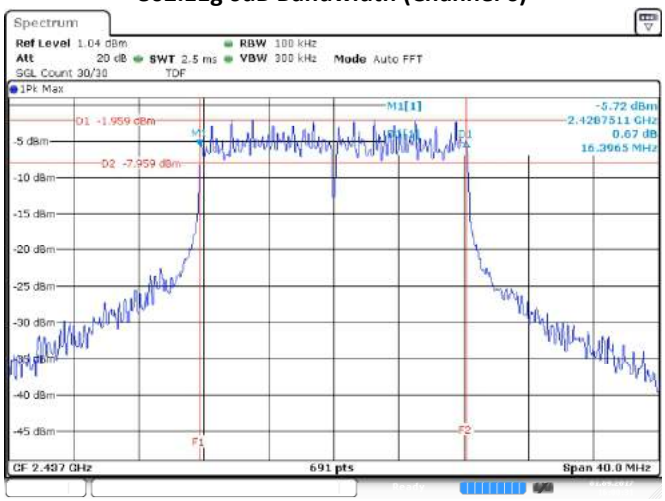

**802.11b 6dB Bandwidth (Channel 11)**



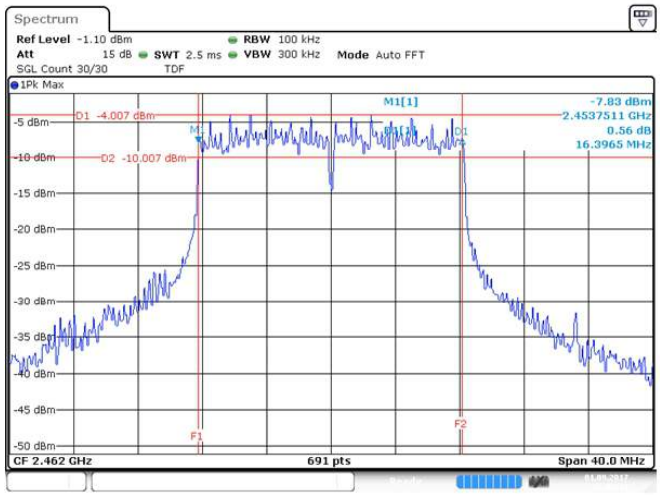
**802.11g 6dB Bandwidth (Channel 1)**



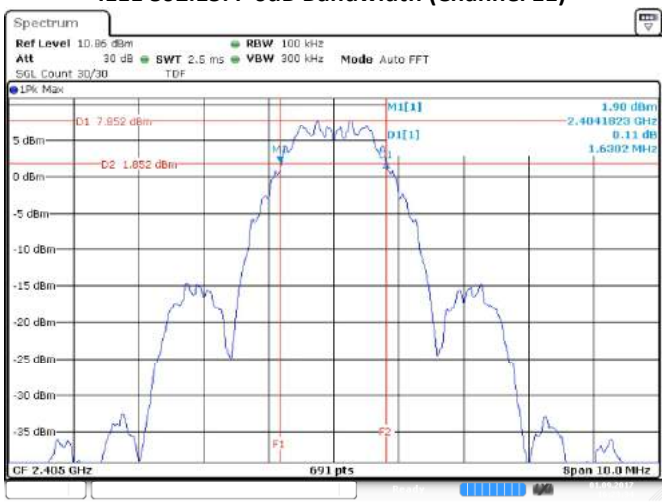

**802.11g 6dB Bandwidth (Channel 6)**



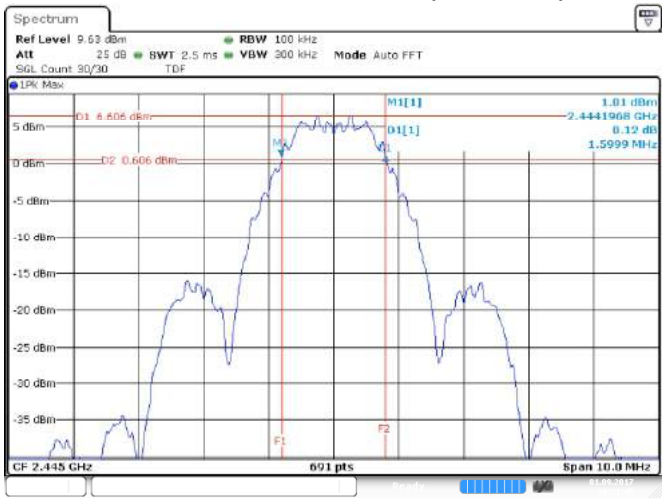

**802.11g 6dB Bandwidth (Channel 11)**



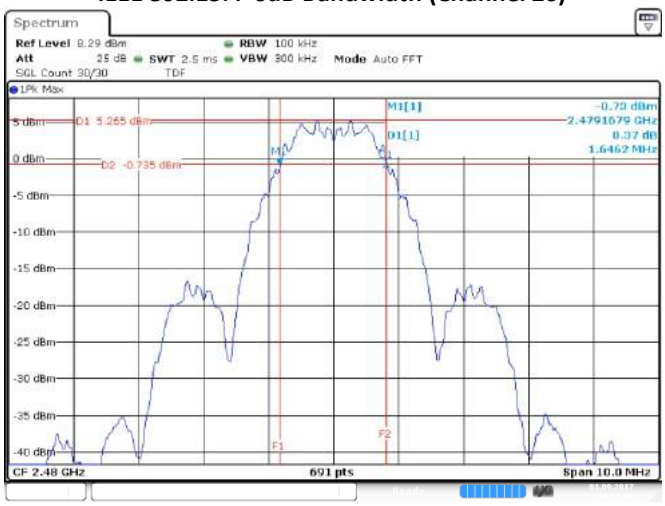
**IEEE 802.15.4 6dB Bandwidth (Channel 11)**




**IEEE 802.15.4 6dB Bandwidth (Channel 19)**




**IEEE 802.15.4 6dB Bandwidth (Channel 26)**



## 3.2 99% Occupied Bandwidth

### 3.2.1 Limit

Reporting only

### 3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

### 3.2.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

### 3.2.4 Test procedure

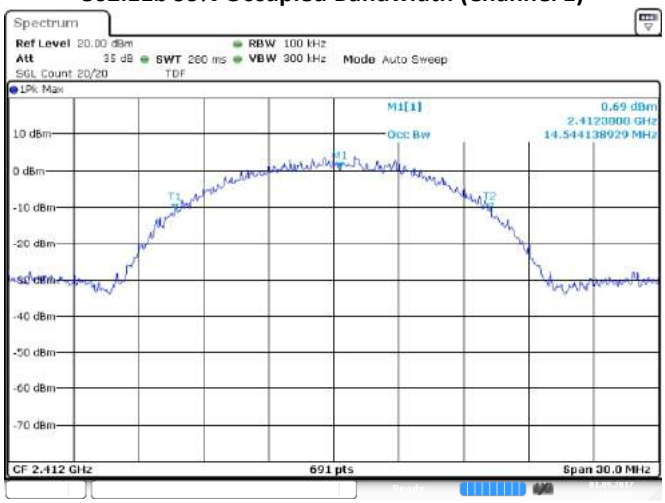
1 Set the centre frequency to the nominal EUT channel centre frequency.
2 Set span = 1.5 times to 0.5 times the Occupied Bandwidth.
3 Set VBW ≥ 3 x RBW.
4 Video averaging is not permitted. Where practical detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode(until the trace stabilizes) shall be used.

### 3.2.5 Test results of the 99% Occupied Bandwidth Measurement

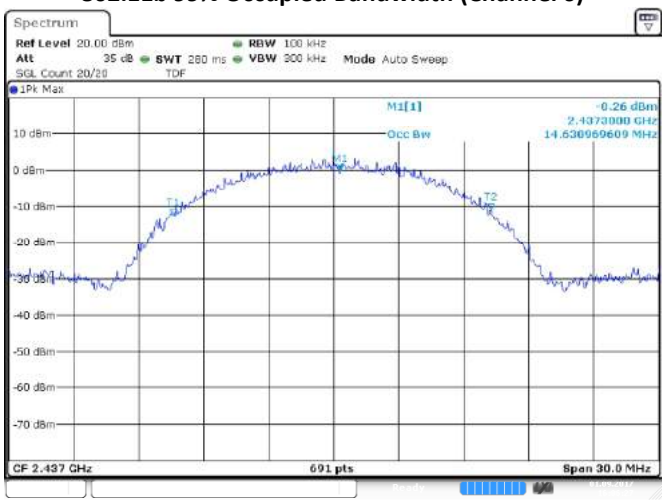
| Technology Std. | Channel | Frequency (MHz) | Data rate | 99% bandwidth (MHz) |
|---|---|---|---|---|
| IEEE 802.11b | 1 | 2412 | 11 Mbps | 14.544 |
| | 6 | 2437 | 11 Mbps | 14.630 |
| | 11 | 2462 | 11 Mbps | 14.500 |
| IEEE 802.11g | 1 | 2412 | 54 Mbps | 16.497 |
| | 6 | 2437 | 54 Mbps | 16.541 |
| | 11 | 2462 | 54 Mbps | 16.584 |
| IEEE 802.15.4 | 11 | 2405 | 250 kbps | 2.570 |
| | 19 | 2445 | 250 kbps | 2.558 |
| | 26 | 2480 | 250 kbps | 2.581 |
| Uncertainty | ± 362 kHz | | | |

### 3.2.6 Plots of the 99% Occupied Bandwidth Measurement

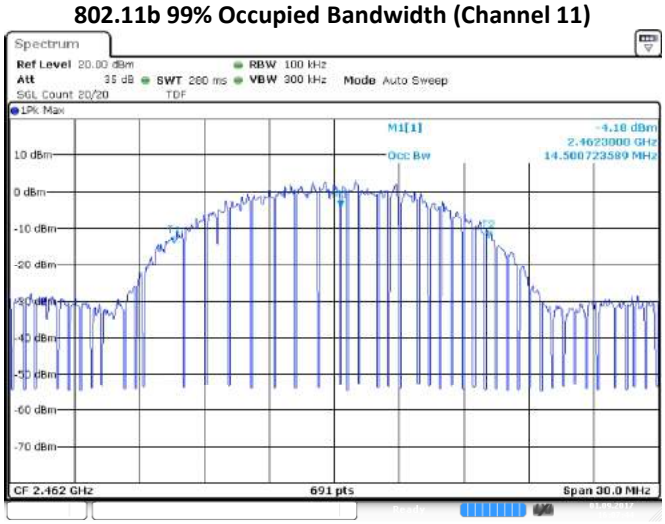
**802.11b 99% Occupied Bandwidth (Channel 1)**



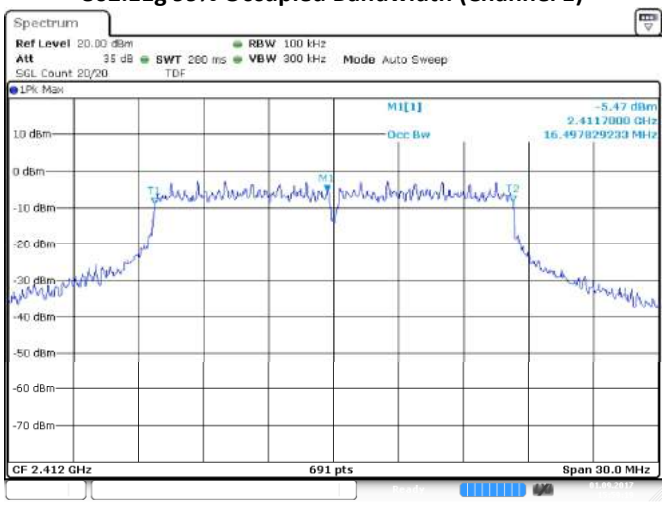

**802.11b 99% Occupied Bandwidth (Channel 6)**



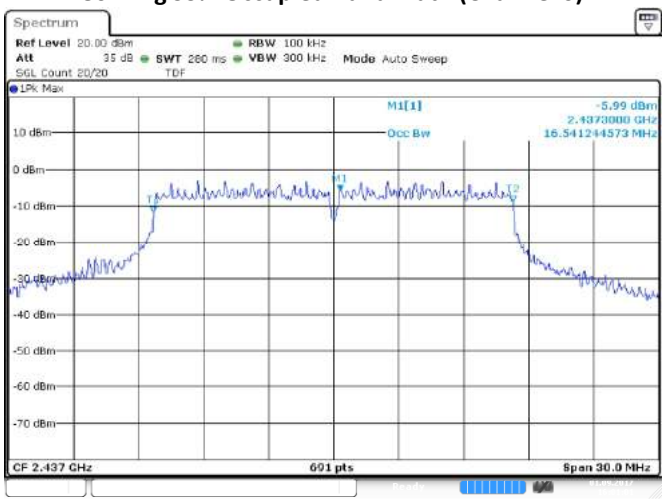

**802.11b 99% Occupied Bandwidth (Channel 11)**



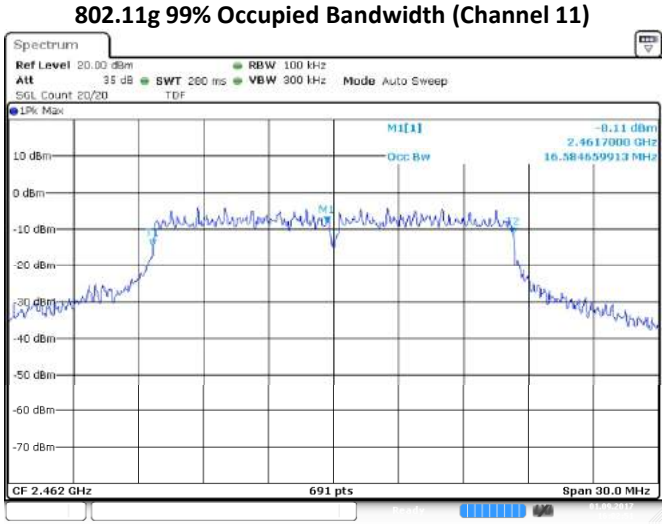
**802.11g 99% Occupied Bandwidth (Channel 1)**



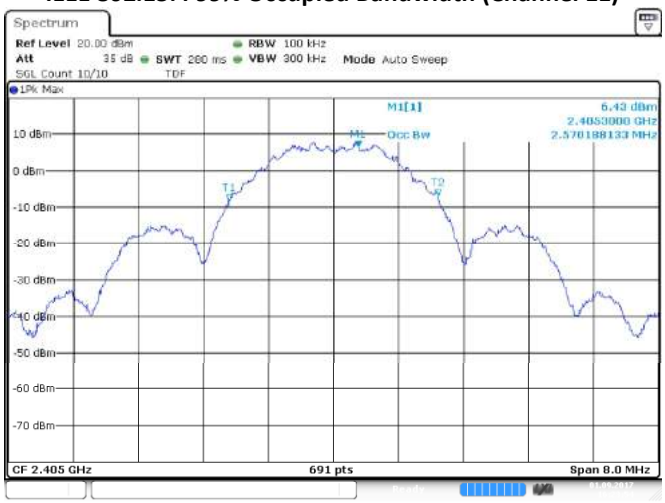

**802.11g 99% Occupied Bandwidth (Channel 6)**



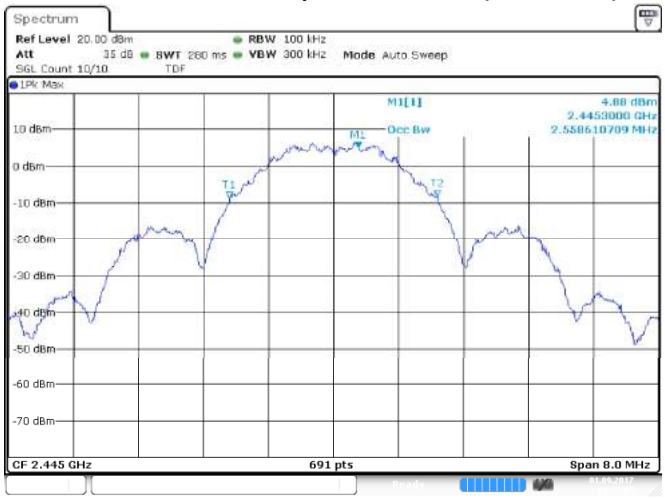

**802.11g 99% Occupied Bandwidth (Channel 11)**



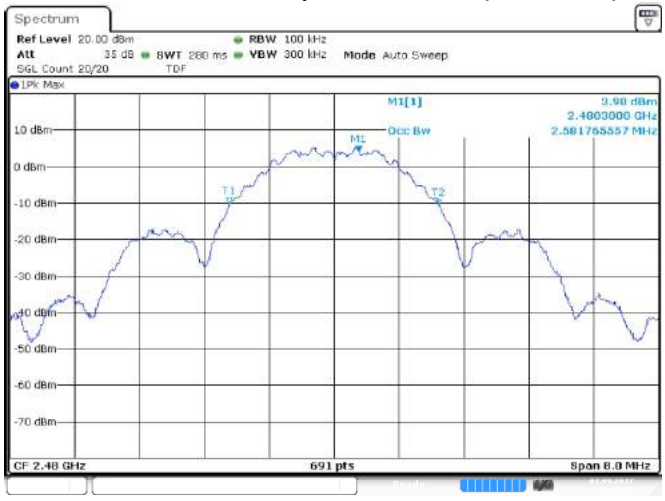
**IEEE 802.15.4 99% Occupied Bandwidth (Channel 11)**




**IEEE 802.15.4 99% Occupied Bandwidth (Channel 19)**




**IEEE 802.15.4 99% Occupied Bandwidth (Channel 26)**



## 3.3 Output Power Measurement

### 3.3.1 Limit

For systems using digital modulation in the 2400-2483.5 MHz, the limit for the peak output power is 30 dBm. If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point to point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

### 3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

### 3.3.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

### 3.3.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.

### 3.3.5 Test results of Output Power Measurement

**Duty cycle**

| Technology Std. | Channel | Frequency (MHz) | Data rate | Duty cycle (%) |
|---|---|---|---|---|
| IEEE 802.11b | 1 | 2412 | 11 Mbps | 75 |
| | 6 | 2437 | 11 Mbps | 75 |
| | 11 | 2462 | 11 Mbps | 75 |
| IEEE 802.11g | 1 | 2412 | 54 Mbps | 60 |
| | 6 | 2437 | 54 Mbps | 60 |
| | 11 | 2462 | 54 Mbps | 60 |
| IEEE 802.15.4 | 11 | 2405 | 250 kbps | 33 |
| | 19 | 2445 | 250 kbps | 33 |
| | 26 | 2480 | 250 kbps | 33 |

**Peak method**

| Technology Std. | Channel | Frequency (MHz) | Data rate | Peak output power (dBm) |
|---|---|---|---|---|
| IEEE 802.11b | 1 | 2412 | 11 Mbps | 20.19 |
| | 6 | 2437 | 11 Mbps | 21.19 |
| | 11 | 2462 | 11 Mbps | 19.82 |
| Uncertainty | ±0.63 dB | | | |

**Peak method**

| Technology Std. | Channel | Frequency (MHz) | Data rate | Peak output power (dBm) |
|---|---|---|---|---|
| IEEE 802.11g | 1 | 2412 | 54 Mbps | 18.02 |
| | 6 | 2437 | 54 Mbps | 17.53 |
| | 11 | 2462 | 54 Mbps | 17.31 |
| Uncertainty | ±0.63 dB | | | |

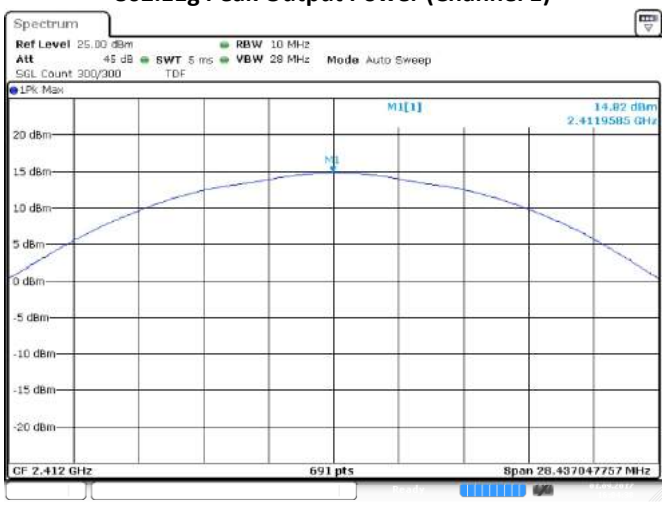
**Peak method**

| Technology Std. | Channels | Frequency (MHz) | Data rate | Peak output power (dBm) |
|---|---|---|---|---|
| IEEE 802.15.4 | 11 | 2425 | 250 kbps | 14.33 |
| | 19 | 2450 | 250 kbps | 13.05 |
| | 26 | 2475 | 250 kbps | 11.93 |
| Uncertainty | ±1.78 dB | | | |

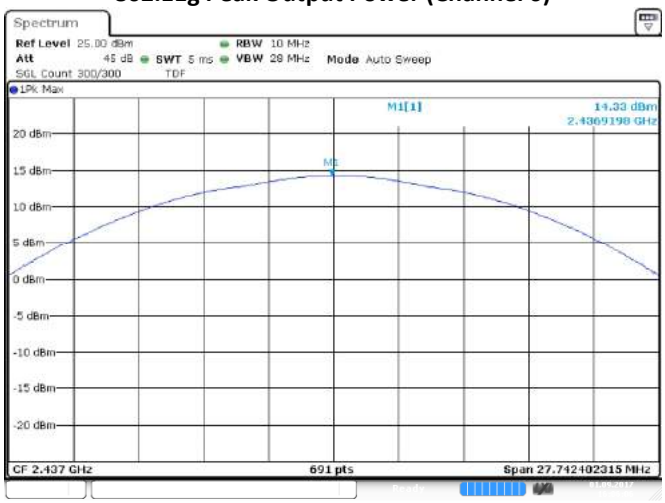
**Note: Output power (dBm) =Conducted output power(dBm) + antenna gain (dBi)**

### 3.3.6 Plots of Output Power Measurement

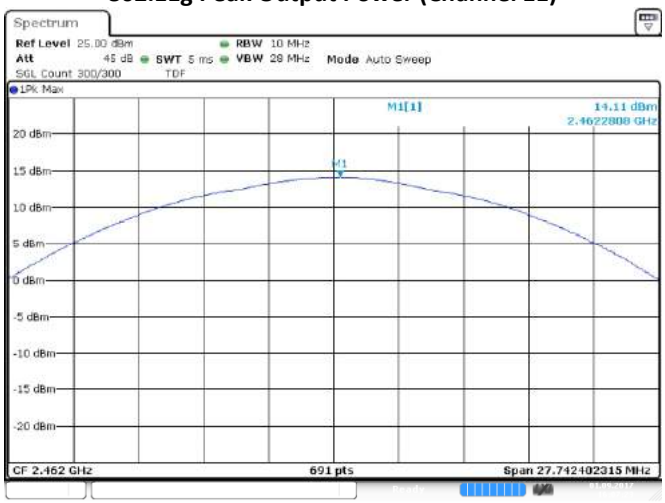
**802.11g Peak Output Power (Channel 1)**



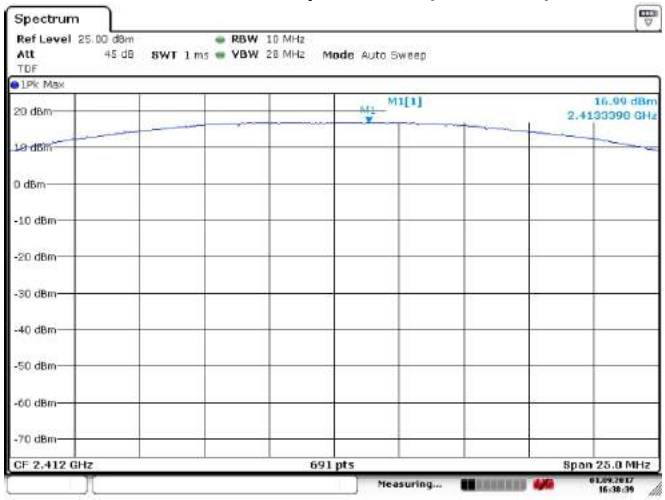

**802.11g Peak Output Power (Channel 6)**



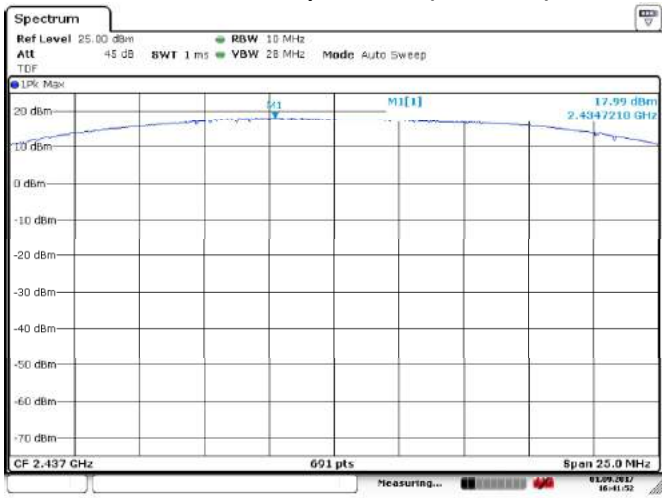

**802.11g Peak Output Power (Channel 11)**



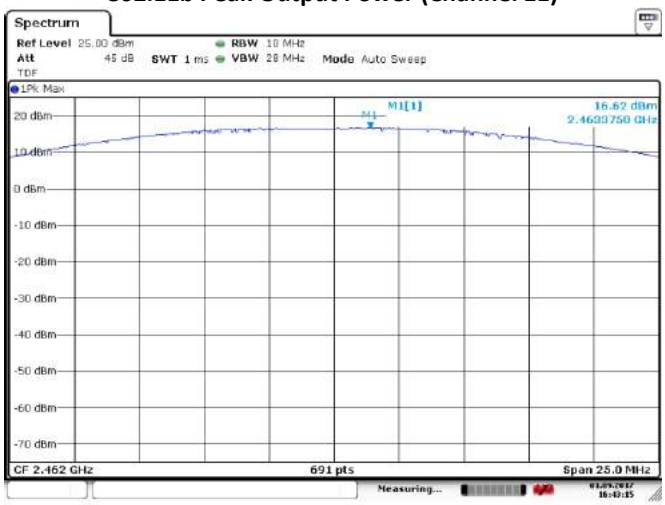
**802.11b Peak Output Power (Channel 1)**



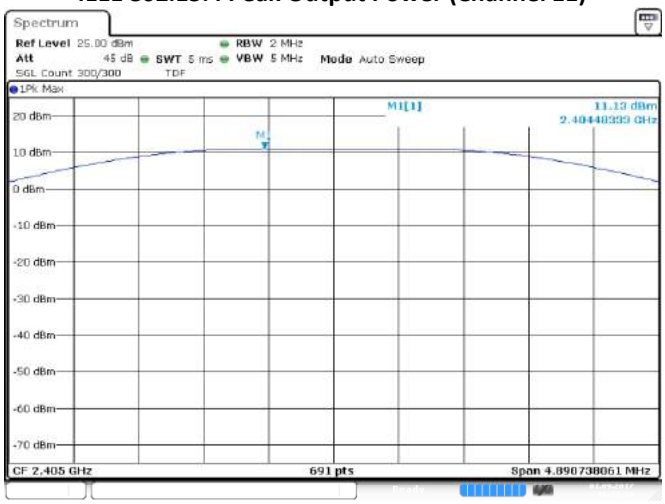

**802.11b Peak Output Power (Channel 6)**



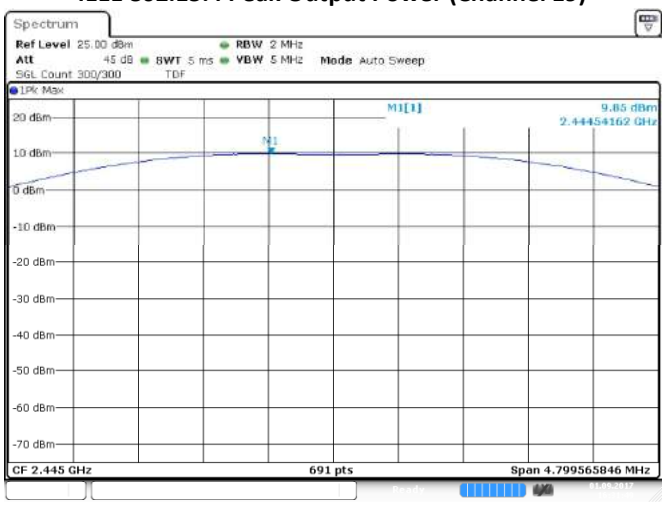

**802.11b Peak Output Power (Channel 11)**



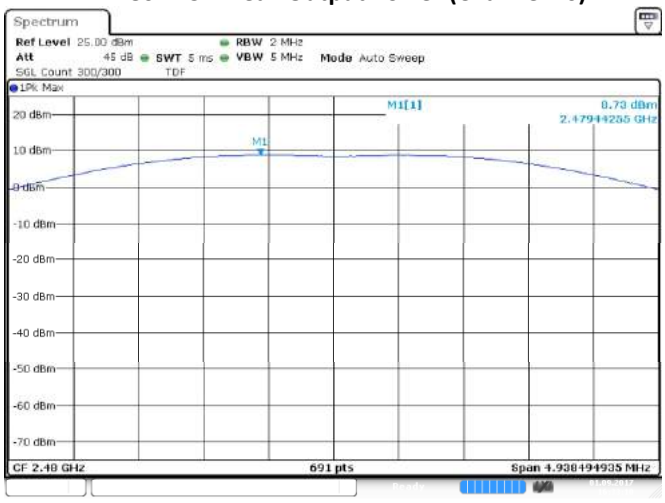
**IEEE 802.15.4 Peak Output Power (Channel 11)**




**IEEE 802.15.4 Peak Output Power (Channel 19)**




**IEEE 802.15.4 Peak Output Power (Channel 26)**



## 3.4 Power Spectral Density

### 3.4.1 Limit

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

### 3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

### 3.4.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

### 3.4.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.

### 3.4.5 Test results of Power Spectral Density Measurement

**Peak Power spectral density**

| Technology Std. | Channel | Frequency (MHz) | Data rate | PSD/3 kHz (dBm) |
|---|---|---|---|---|
| IEEE 802.11b | 1 | 2412 | 11 Mbps | -11.34 |
| | 6 | 2437 | 11 Mbps | -11.88 |
| | 11 | 2462 | 11 Mbps | -12.33 |
| Uncertainty | ±0.63 dB | | | |

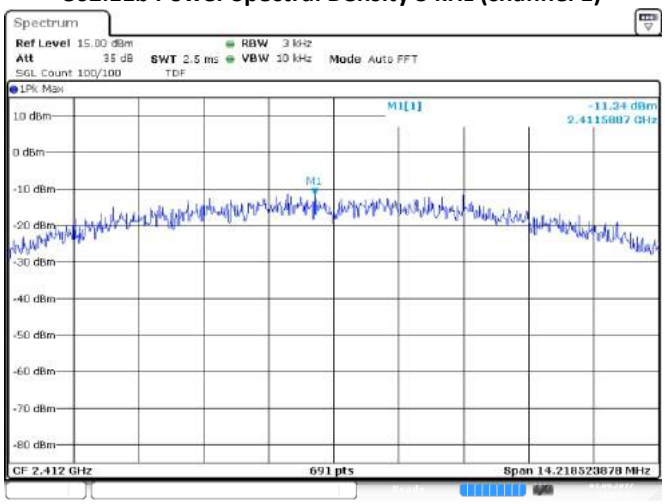
**Average Power spectral density**

| Technology Std. | Channels | Frequency (MHz) | Data rate | PSD/100 kHz (dBm) |
|---|---|---|---|---|
| IEEE 802.11g | 1 | 2412 | 54 Mbps | -18.92 |
| | 6 | 2437 | 54 Mbps | -19.16 |
| | 11 | 2462 | 54 Mbps | -20.28 |
| Uncertainty | ±0.63 dB | | | |

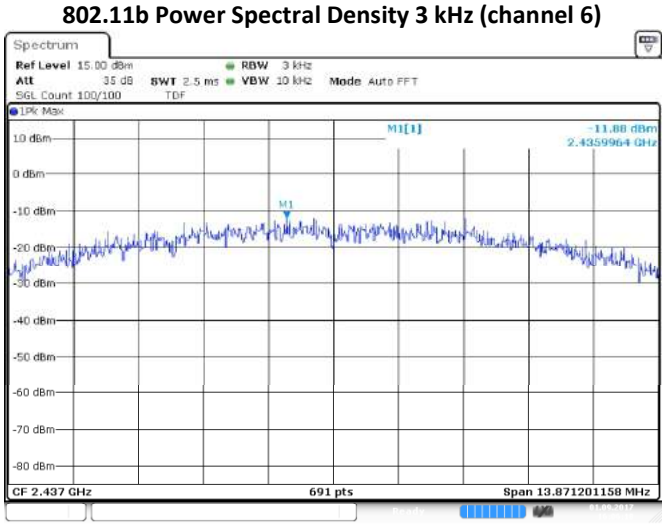
| Technology Std. | Channels | Frequency (MHz) | Data rate | PSD/100 kHz (dBm) |
|---|---|---|---|---|
| IEEE 802.15.4 | 11 | 2425 | 250 kbps | 6.20 |
| | 19 | 2450 | 250 kbps | 5.41 |
| | 26 | 2475 | 250 kbps | 4.42 |
| Uncertainty | ±0.63 dB | | | |

### 3.4.6 Plots of the Power Spectral Density Measurements

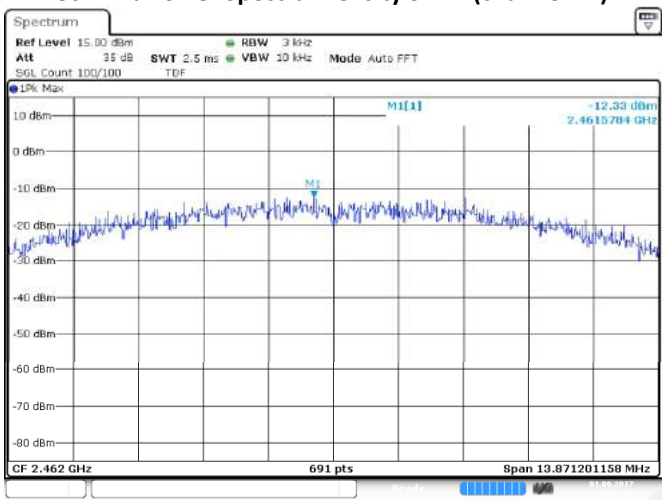
**802.11b Power Spectral Density 3 kHz (channel 1)**



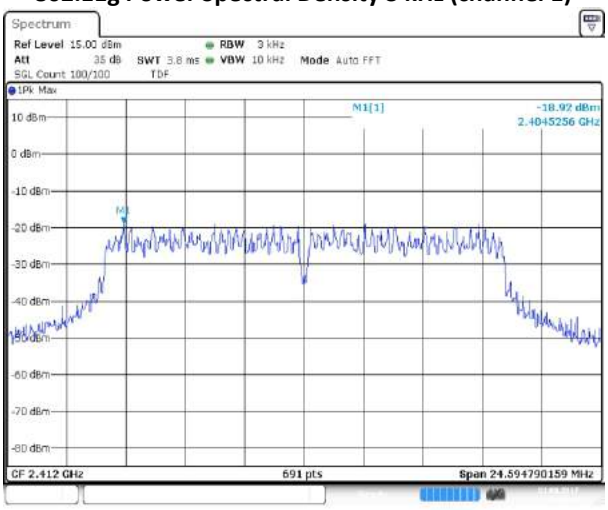

**802.11b Power Spectral Density 3 kHz (channel 6)**



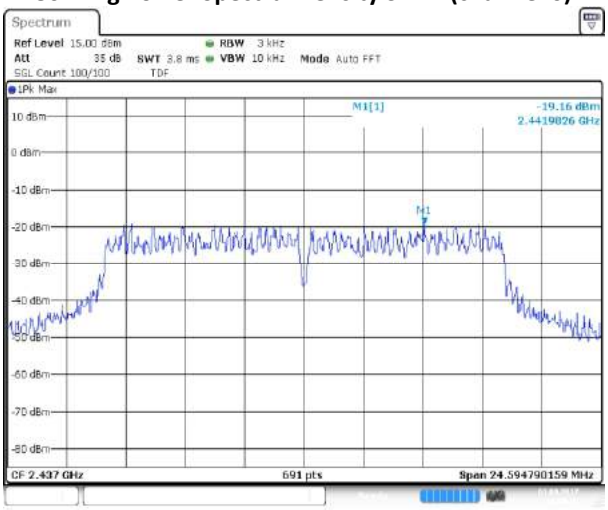

**802.11b Power Spectral Density 3 kHz (channel 11)**



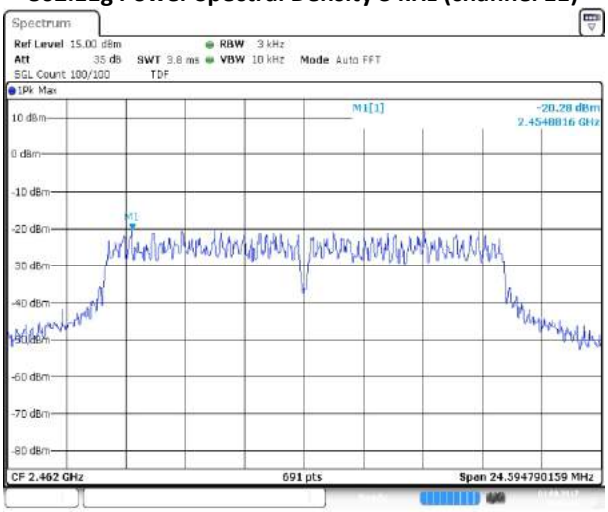
**802.11g Power Spectral Density 3 kHz (channel 1)**



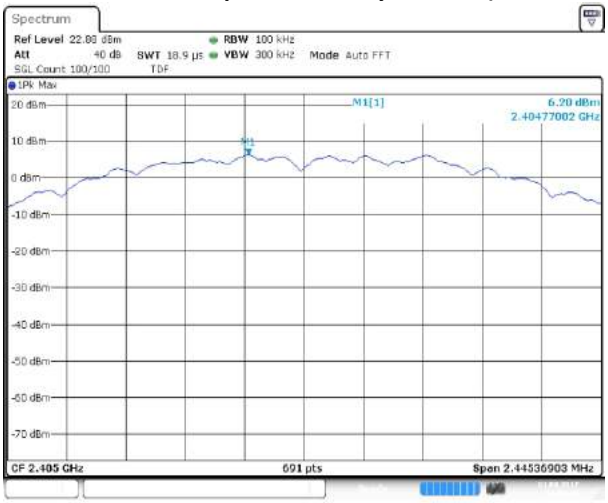

**802.11g Power Spectral Density 3 kHz (channel 6)**



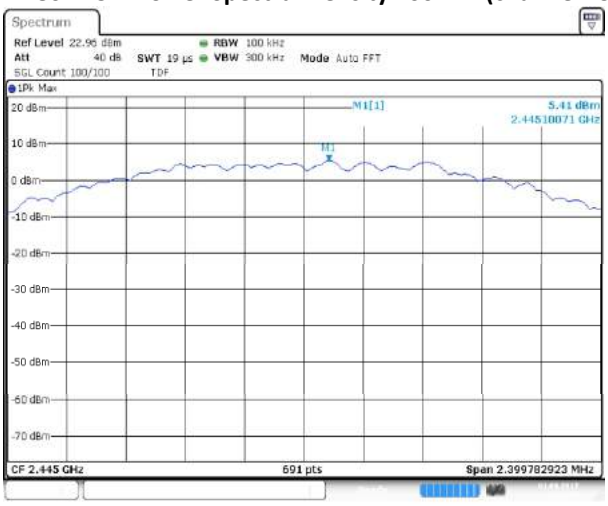

**802.11g Power Spectral Density 3 kHz (channel 11)**



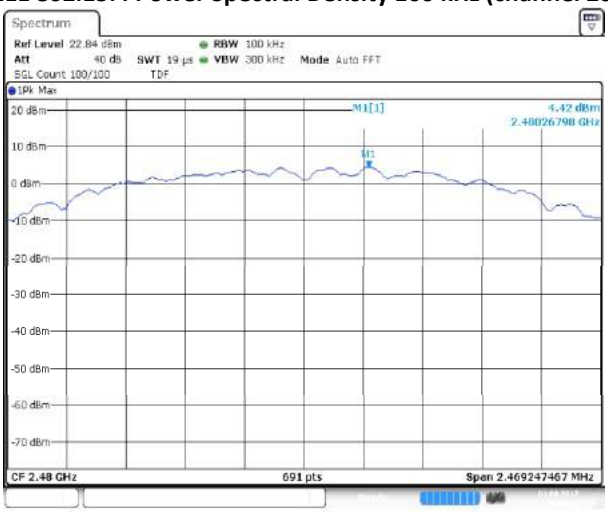
**IEEE 802.15.4 Power Spectral Density 100 kHz (channel 11)**




**IEEE 802.15.4 Power Spectral Density 100 kHz (channel 19)**




**IEEE 802.15.4 Power Spectral Density 100 kHz (channel 26)**



## 3.5 Conducted Spurious Emissions Measurement

### 3.5.1 Limit

**Spurious Emissions:**
In any 100 kHz bandwidth outside the operating frequency band, the RF power shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either a RF conducted or a radiated measurement.

### 3.5.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

### 3.5.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

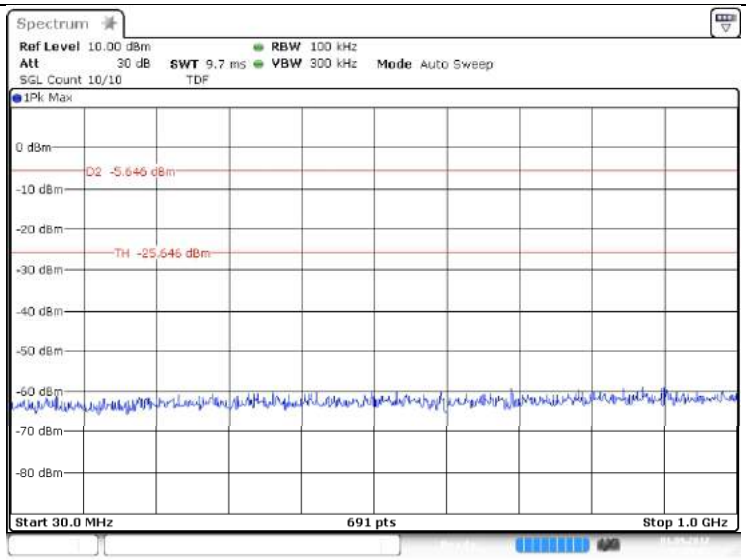
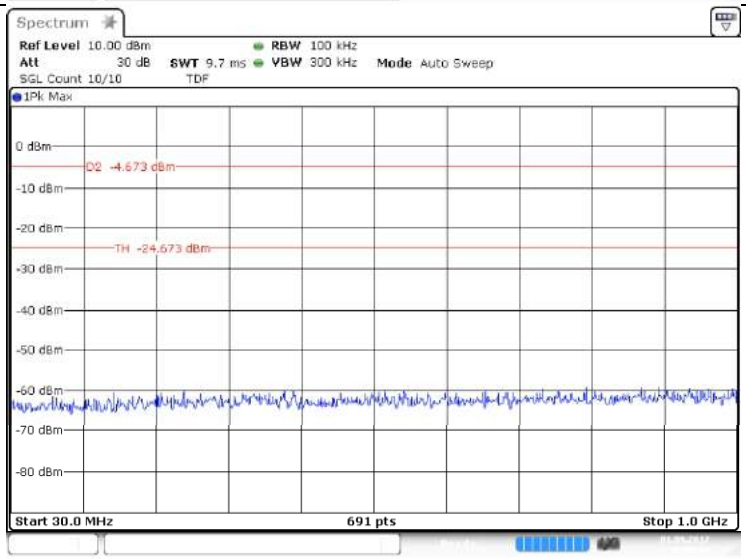
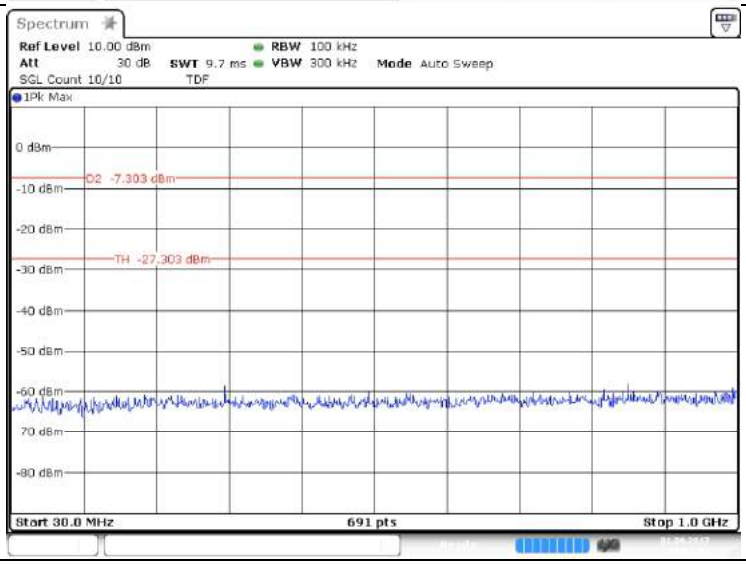
### 3.5.4 Test procedure

According to KDB Publication 558074 V03r05, sections 11.3 and 12.1

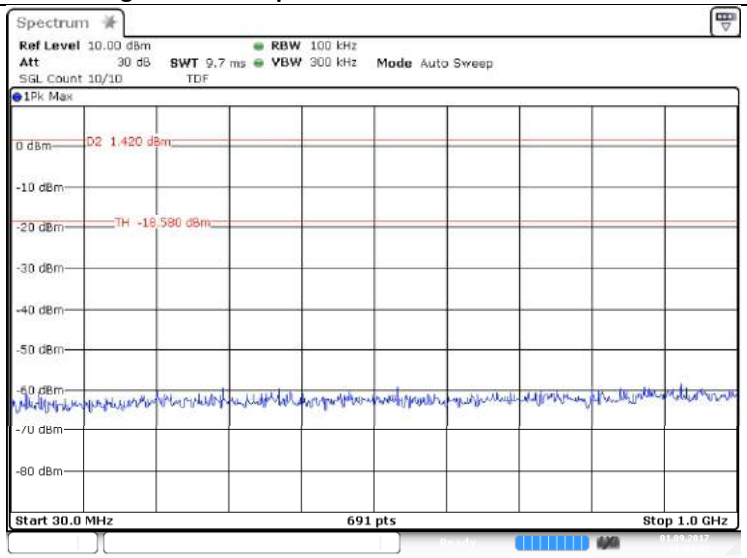
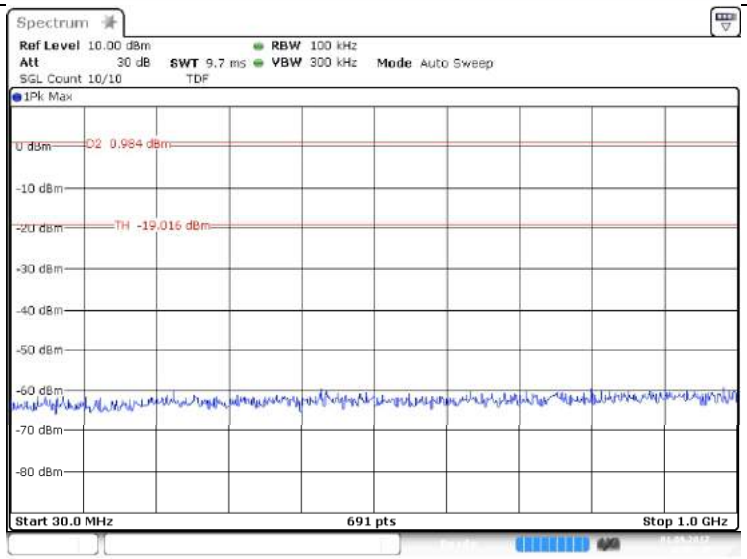
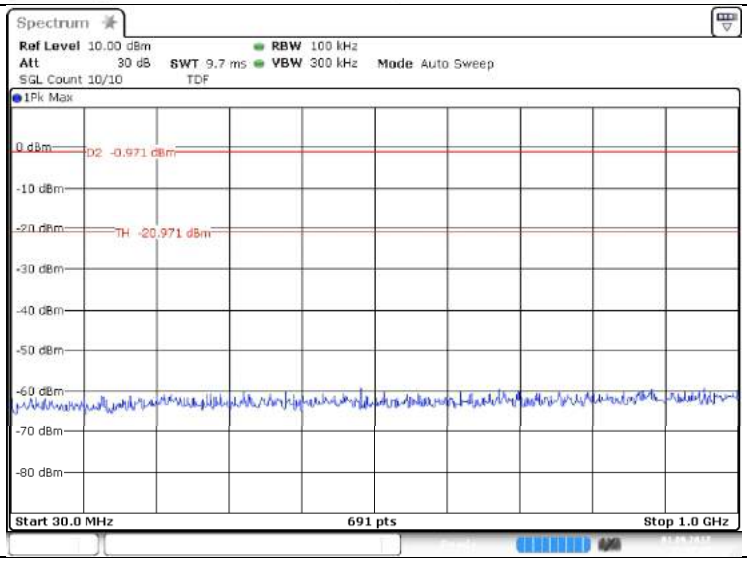
### 3.5.5 Test results of conducted Spurious Emissions Measurements

See next page

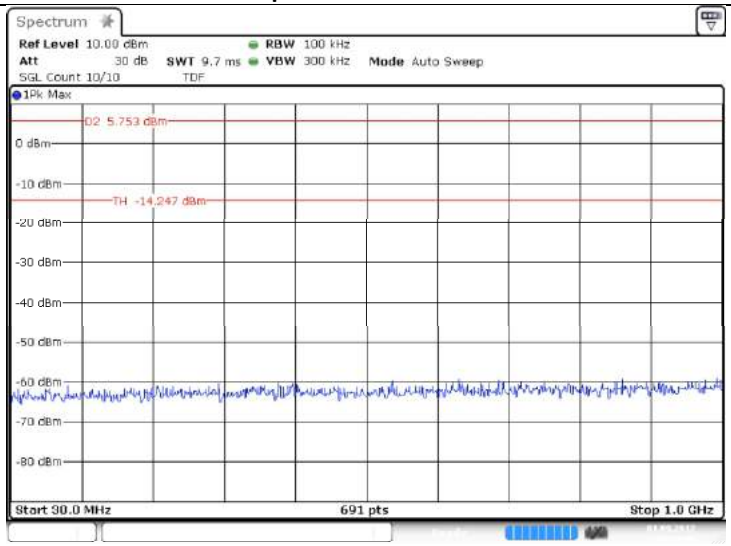
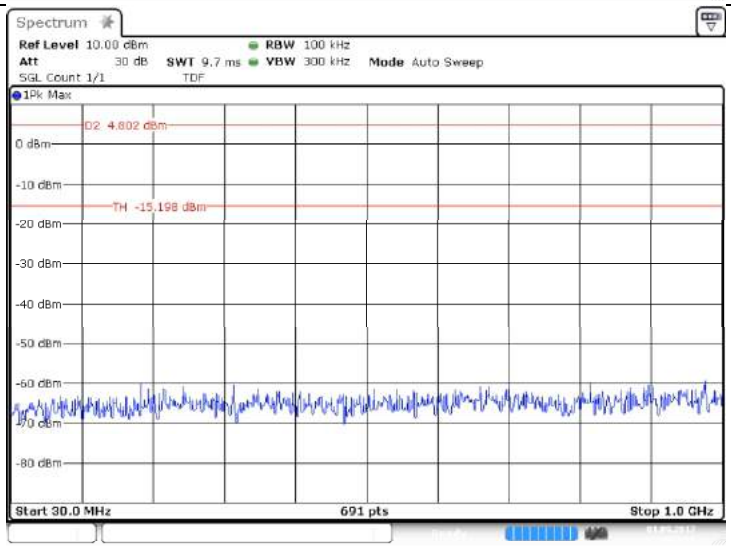
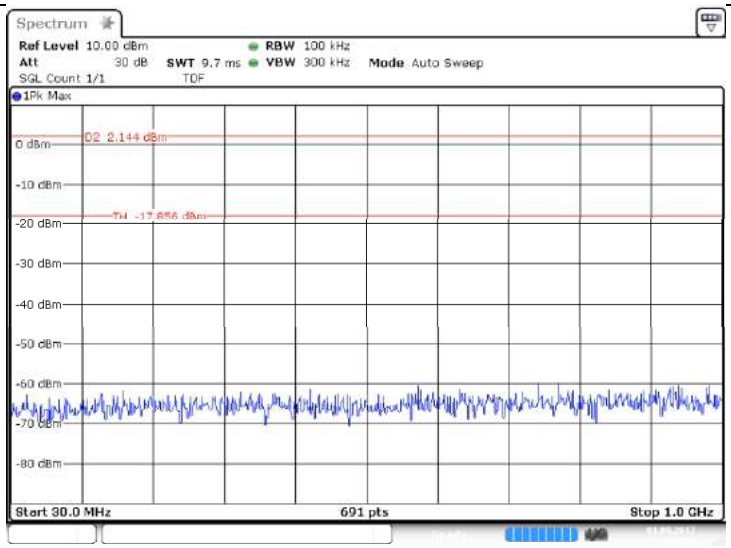
**IEEE 802.11b Conducted Spurious Emissions 30 – 1000 MHz**

| | |
|---|---|
| **Ch. 1** |  |
| **Ch. 6** |  |
| **Ch. 11** |  |

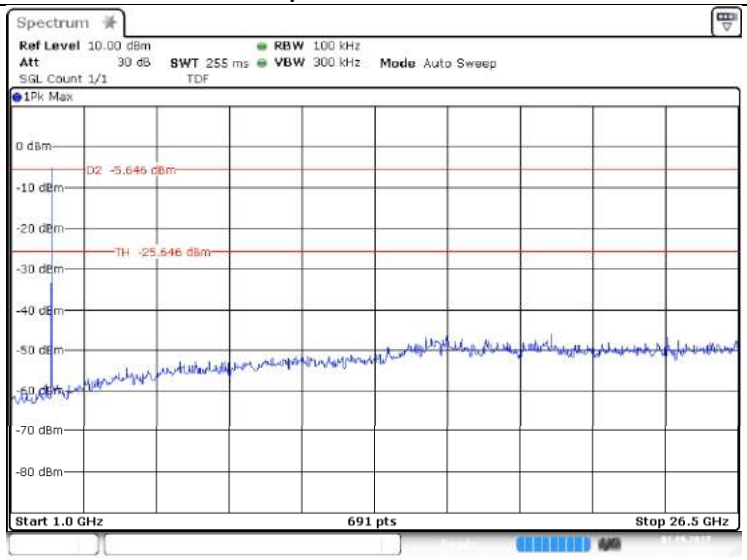
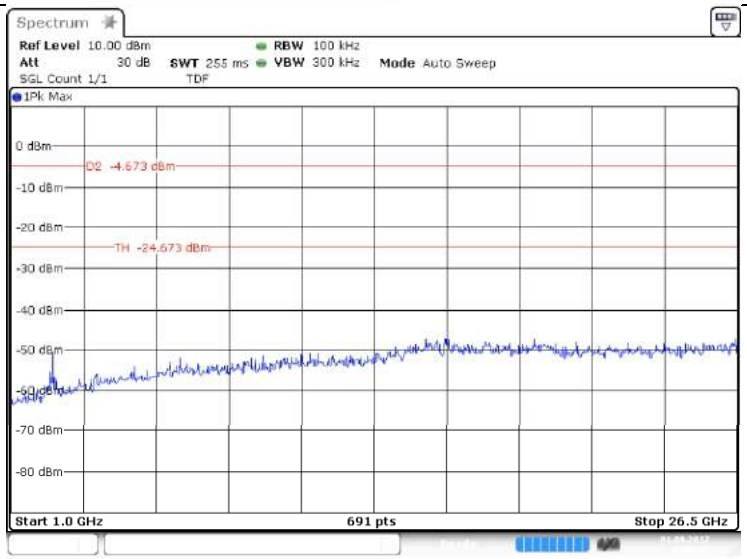
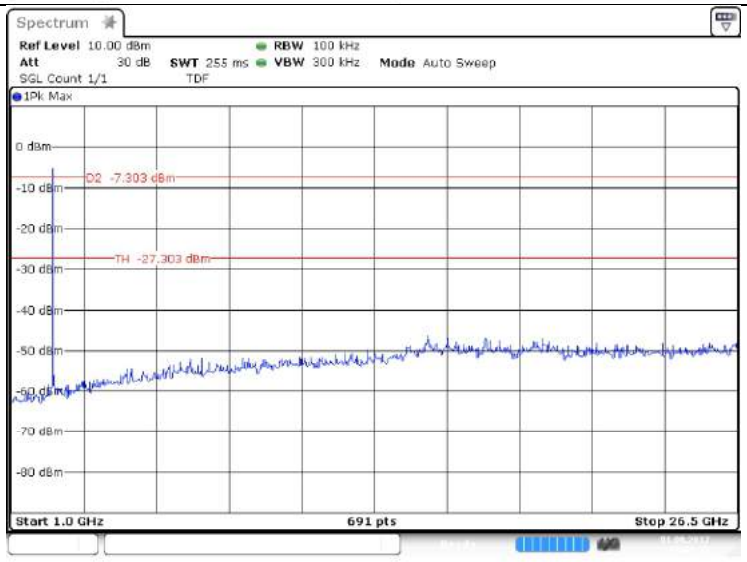
**IEEE 802.11g Conducted Spurious Emissions 30 – 1000 MHz**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

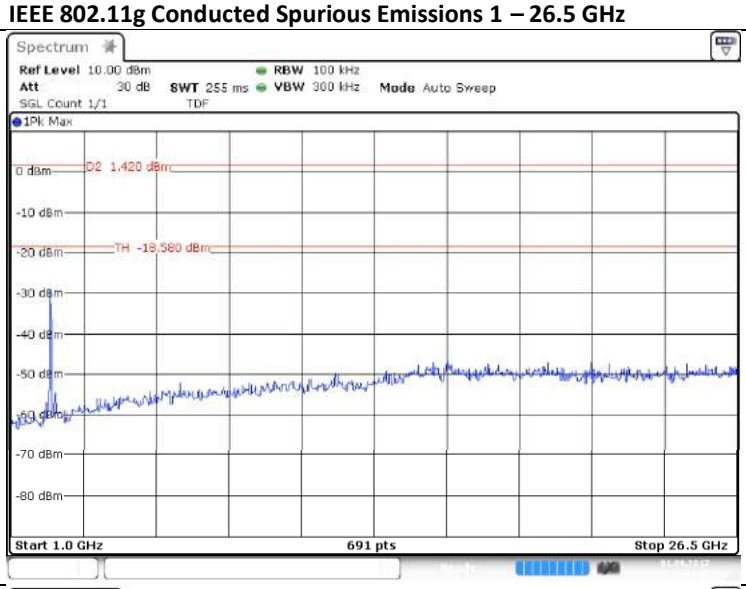
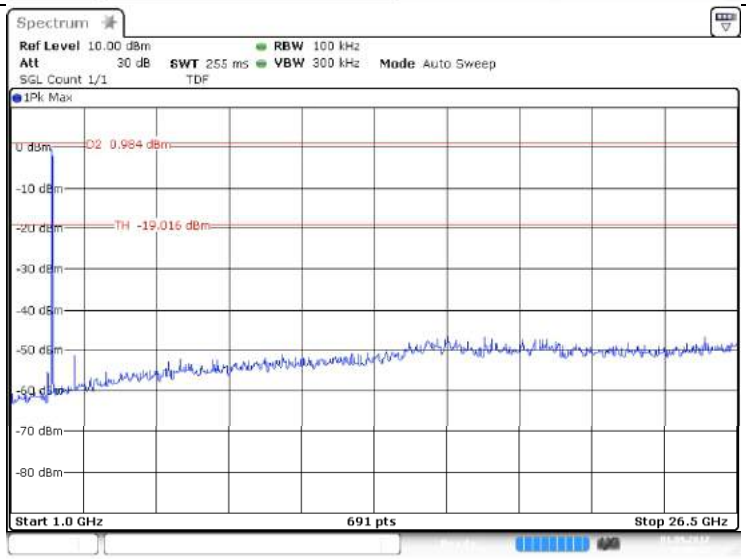
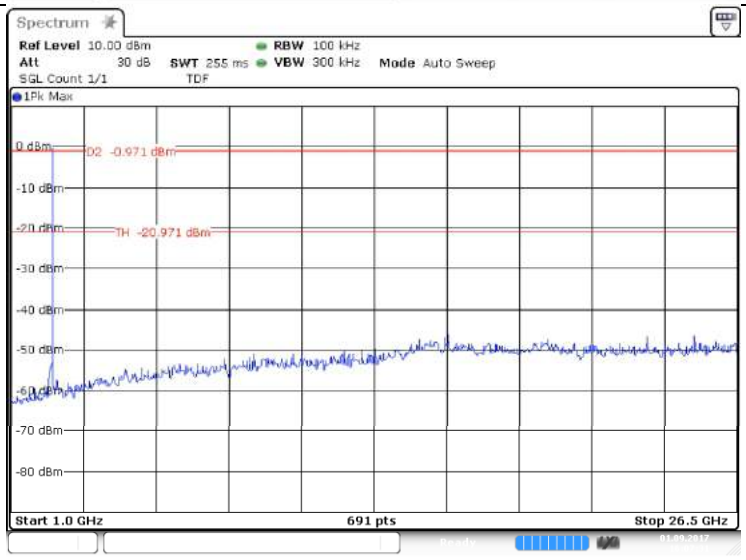
**IEEE 802.15.4 Conducted Spurious Emissions 30 – 1000 MHz**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

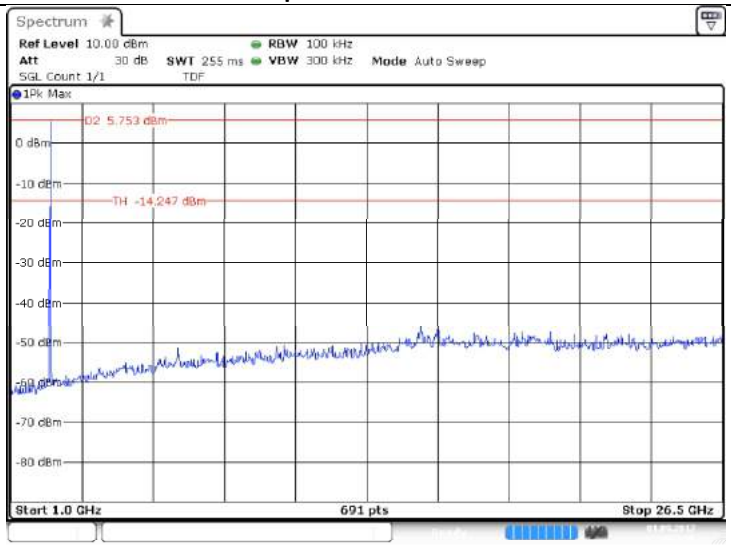
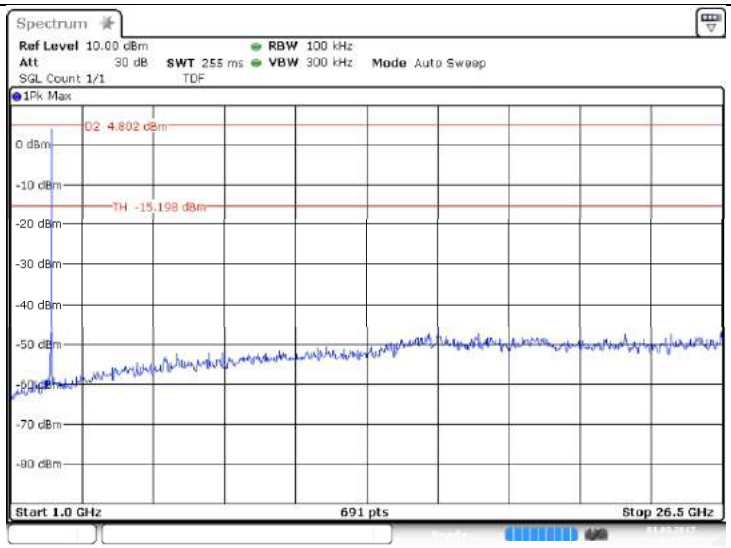
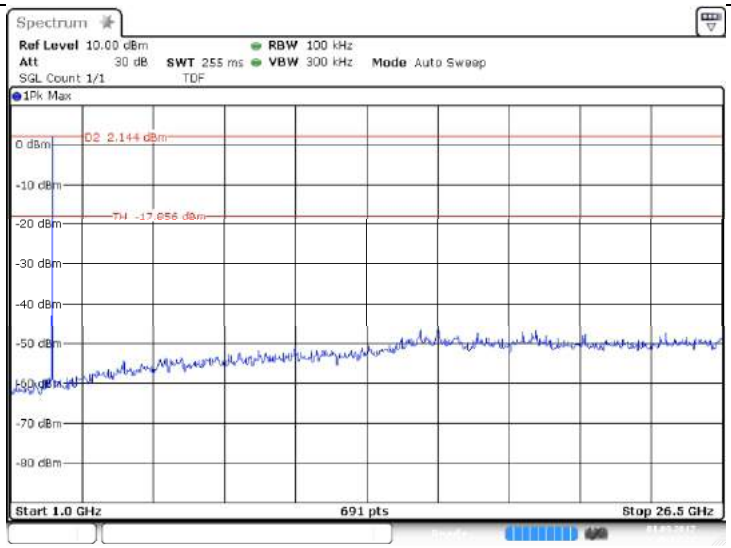
**IEEE 802.11b Conducted Spurious Emissions 1 – 26.5 GHz**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

**IEEE 802.11g Conducted Spurious Emissions 1 – 26.5 GHz**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

**IEEE 802.15.4 Conducted Spurious Emissions 1 – 26.5 GHz**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

## 3.6 Radiated Spurious Emissions Measurement (incl. Restricted bands)

### 3.6.1 Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

**15.209**

| Frequency (MHz) | Field strength (µV/m) | Measurement distance(m) |
|---|---|---|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 - 30 | 30 | 30 |
| 30 -88 | 100 | 3 |
| 88 - 216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 3.6.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

### 3.6.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

### 3.6.4 Test procedure

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz.
Radiated emission limits in these three bands are based on measurements employing an average detector.

Other details are according to KDB Publication 558074 V02r05, sections 11.3 and 12.1

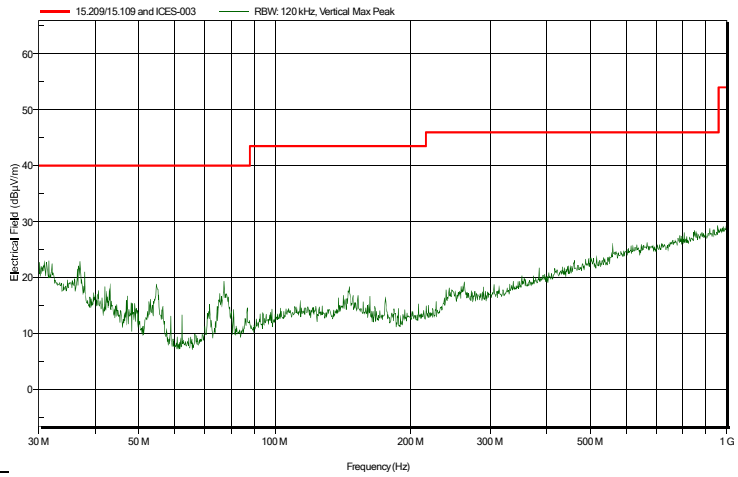
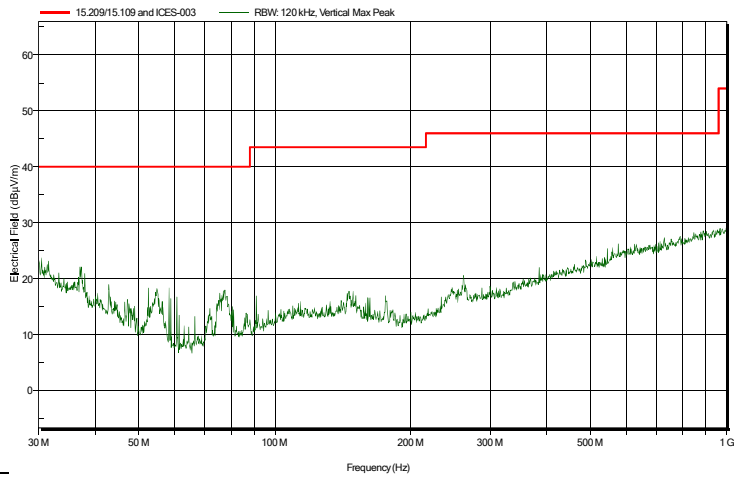
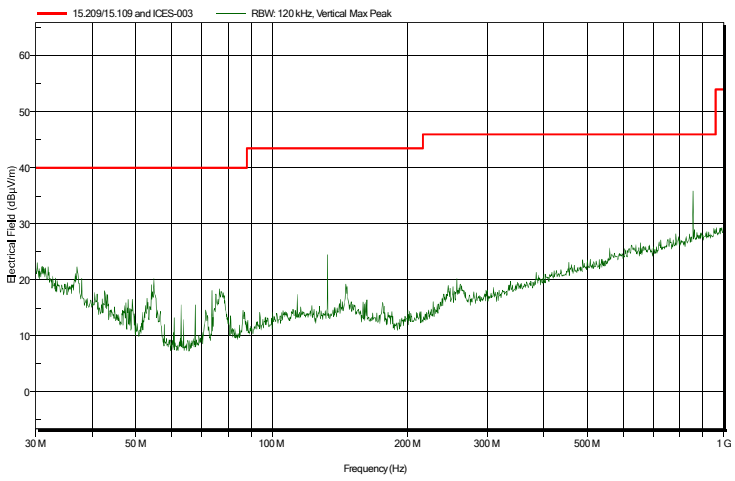
### 3.6.5 Notes

- In the frequency range of 1 – 18 GHz the green trace is measured using a peak detector and the red trace is measured using an average detector. The top limit line represent the peak limit and the bottom limit represents the average limit

## 3.6.6 Plots of the Radiated Spurious Emissions Measurement

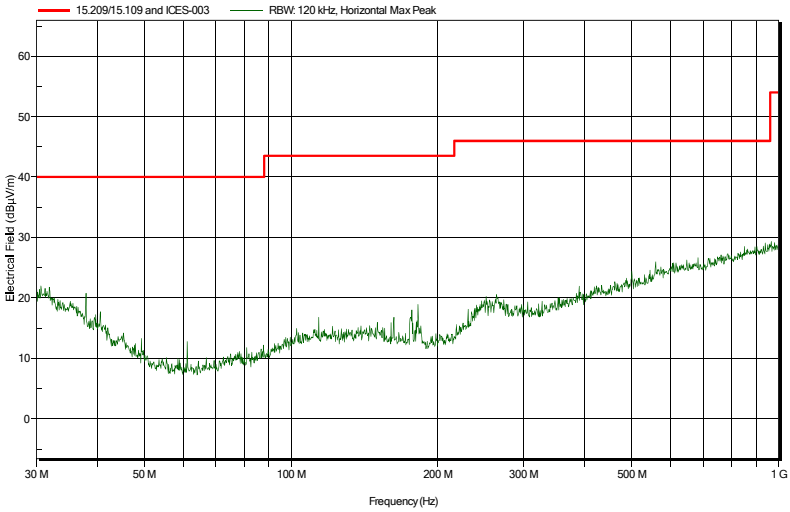
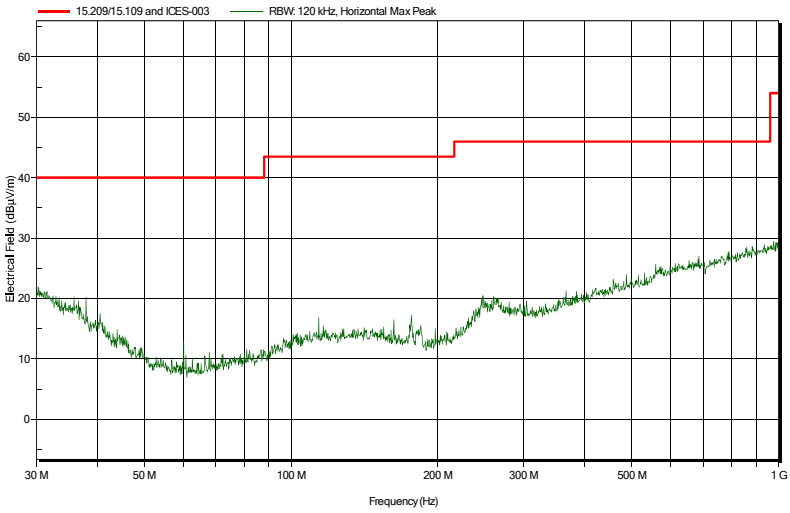
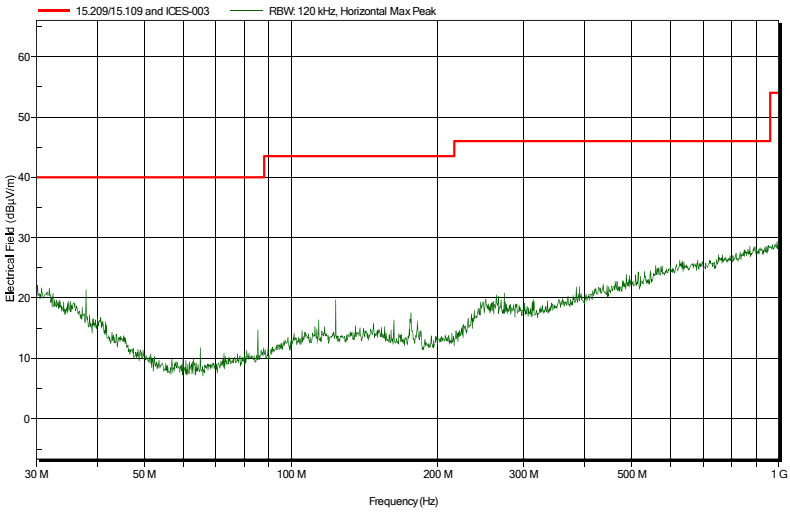
**30 MHz to 1 GHz**

**Vertical polarization, 802.11b**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

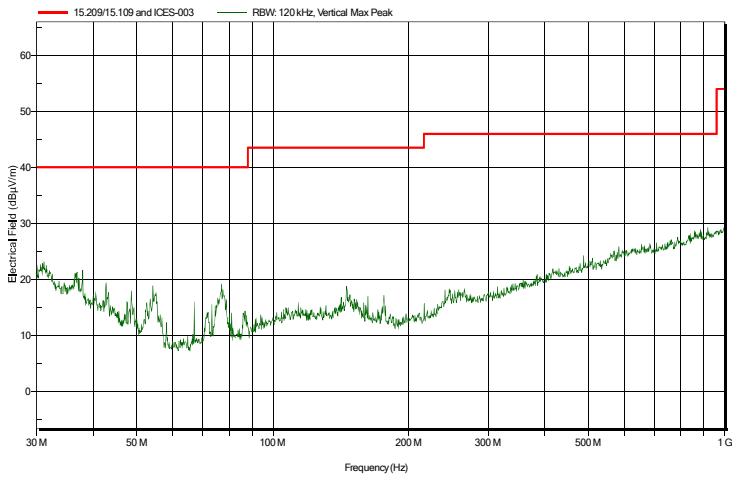
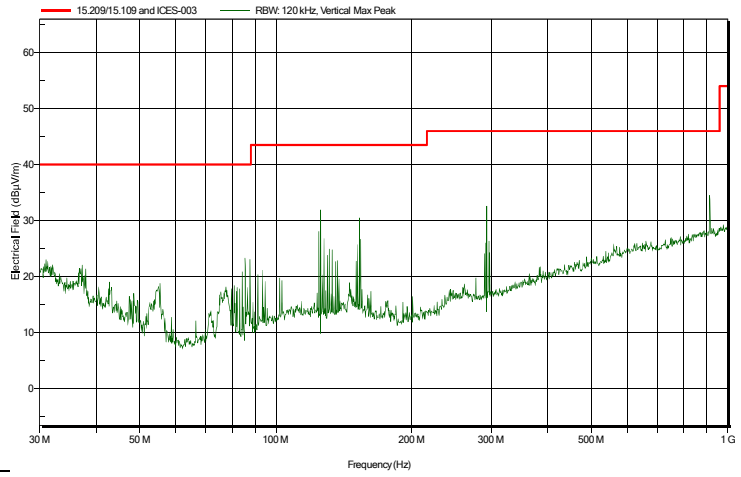
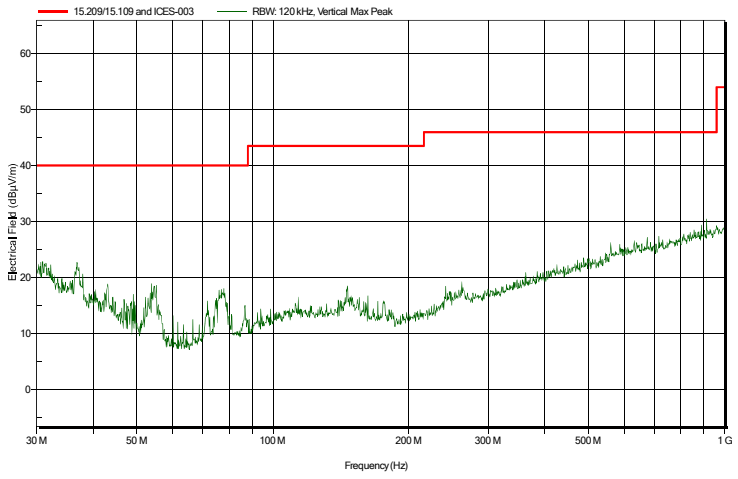
**30 MHz to 1 GHz**

**Horizontal polarization, 802.11b**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

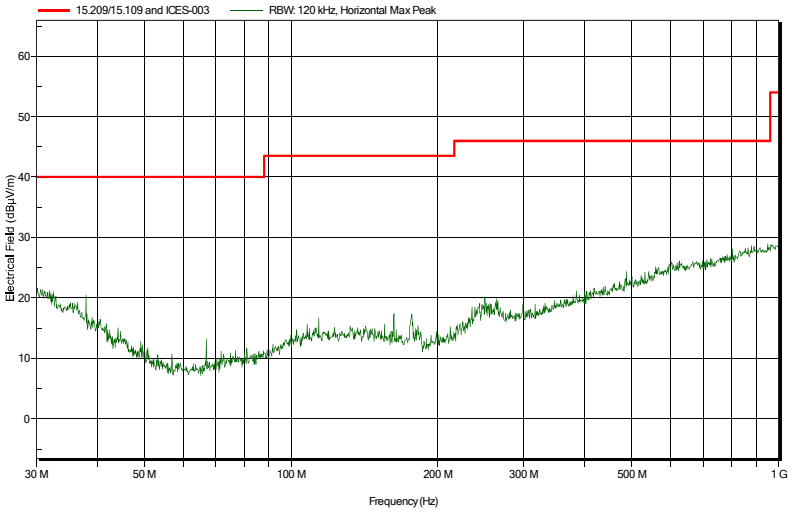
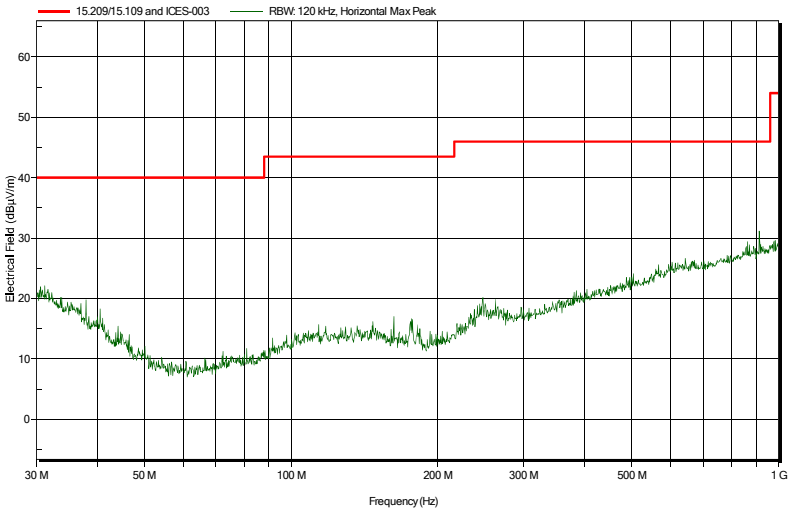
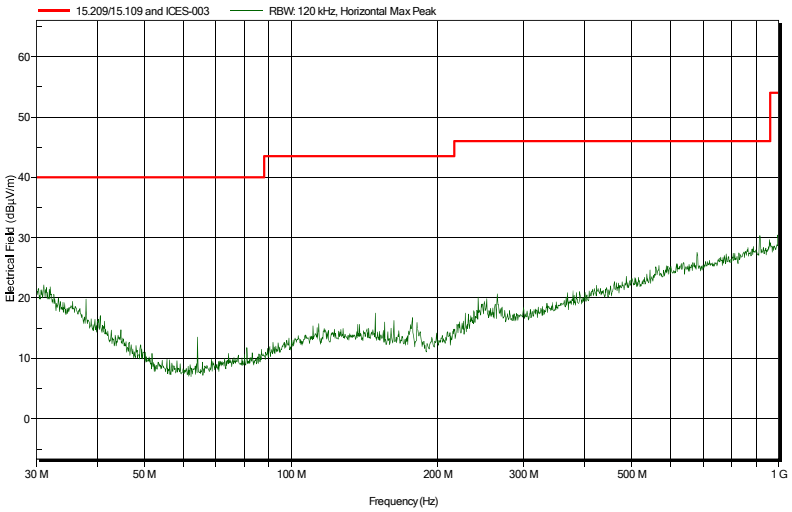
**30 MHz to 1 GHz**

**Vertical polarization, 802.11g**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

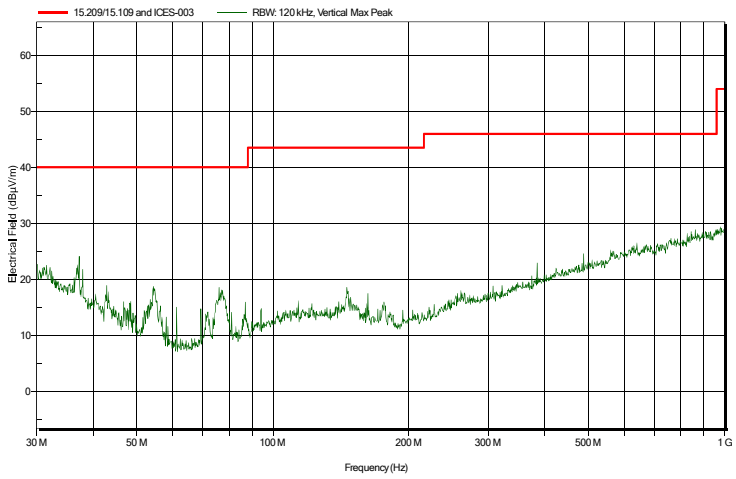
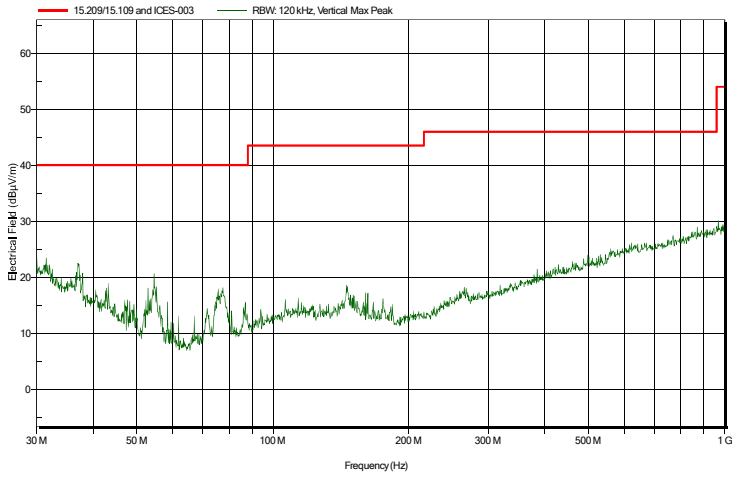
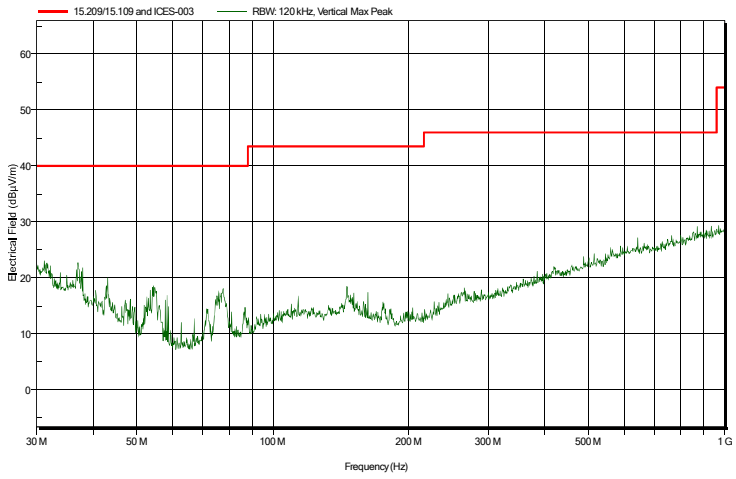
**30 MHz to 1 GHz**

**Horizontal polarization, 802.11g**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

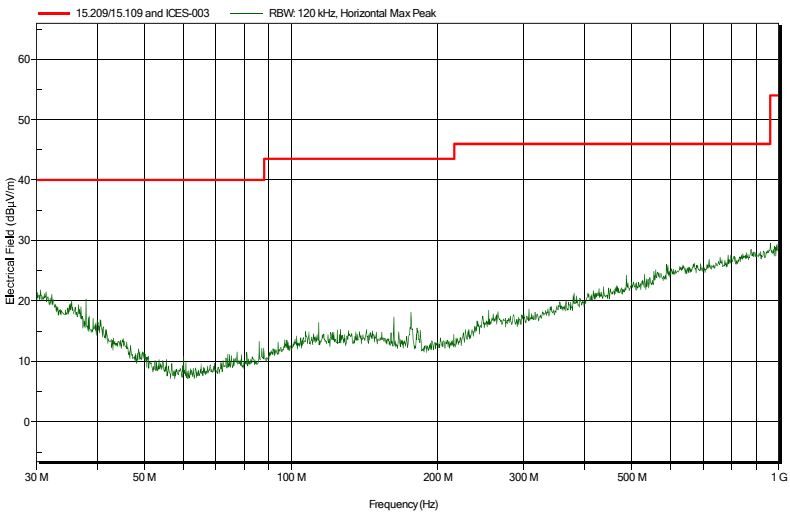
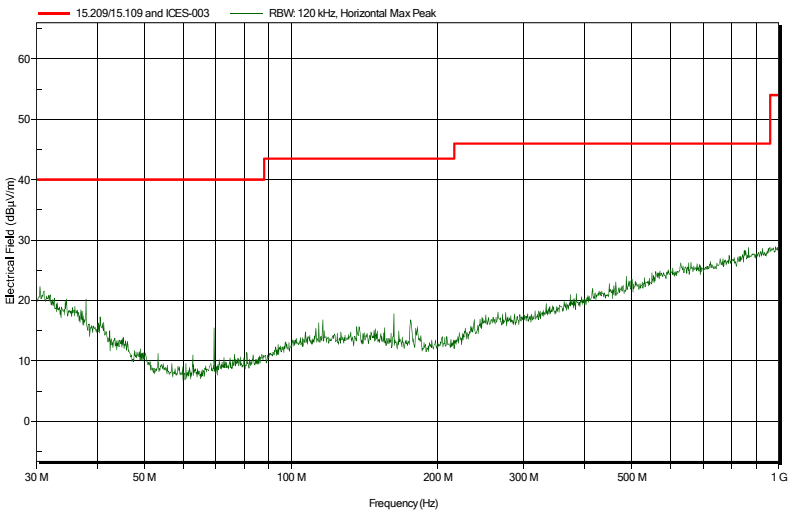
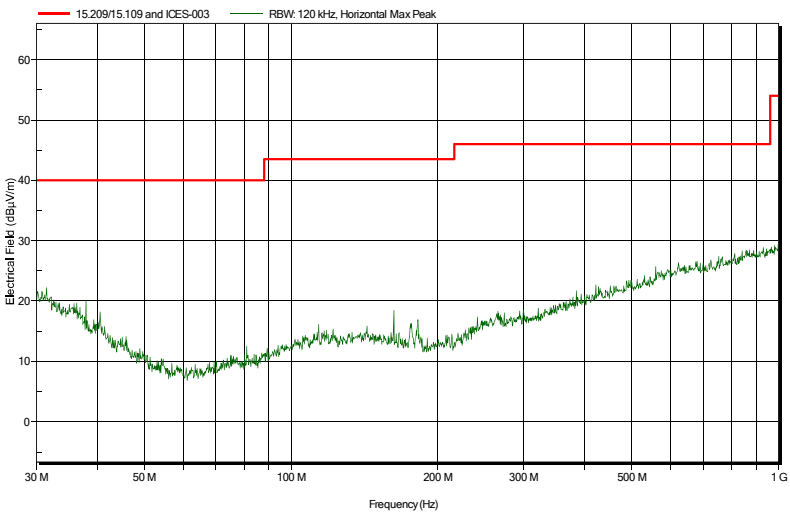
**30 MHz to 1 GHz**

**Vertical polarization, 802.15.4**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

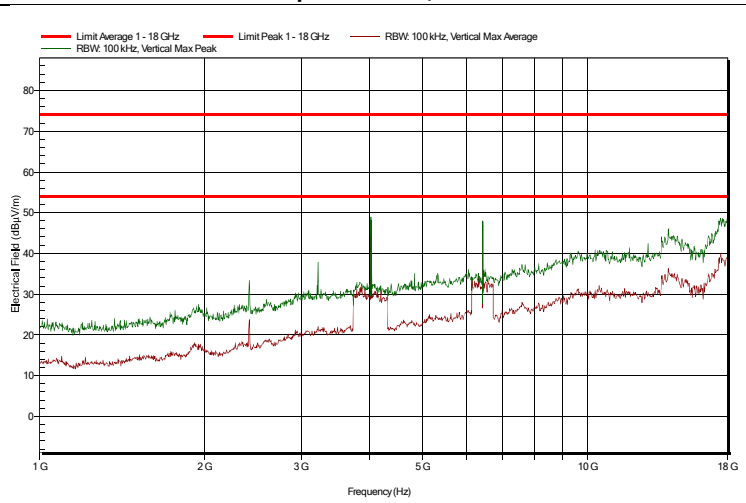
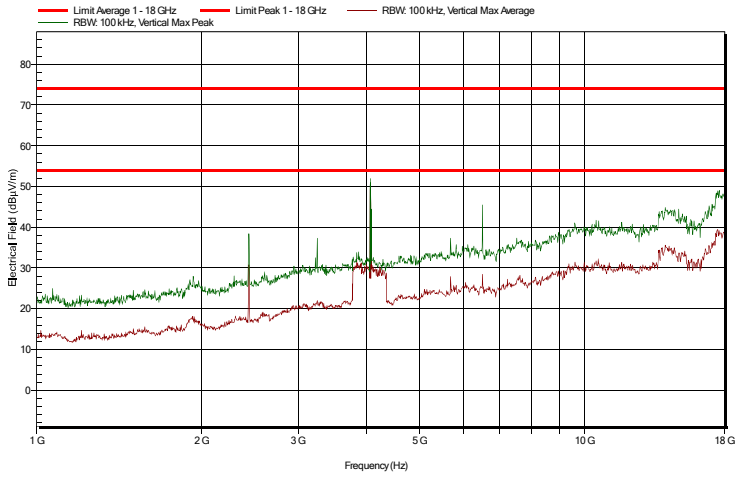
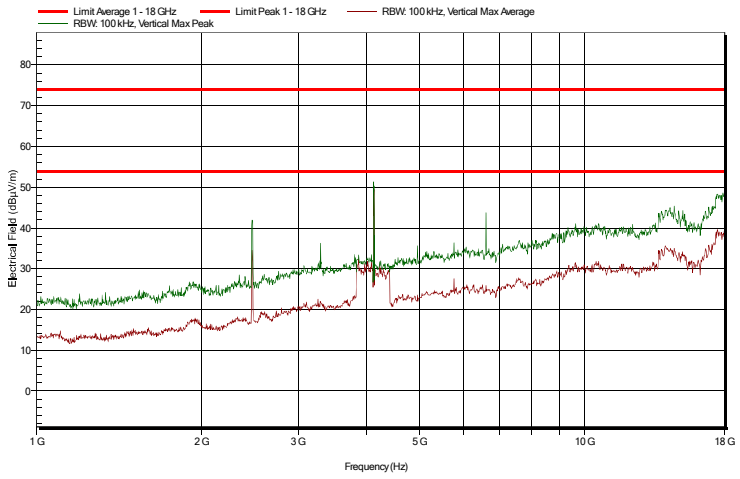
**30 MHz to 1 GHz**

**Horizontal polarization, 802.15.4**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

**1 GHz to 18 GHz**

**Vertical polarization, 802.11b**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

**Measured peaks Vertical 1 – 18 GHz Low channel**

| Frequency (GHz) | Pol | Height | Average (dBµV/m) | Average Limit (dBµV/m) | Average margin (dB) |
|---|---|---|---|---|---|
| 4,02 | Vert | 1 m | 40,5 | 54 | -13,5 |
| 6,432 | Vert | 2,5 m | 46,5 | 54 | -7,5 |

**Measured peaks Vertical 1 – 18 GHz Middle channel**

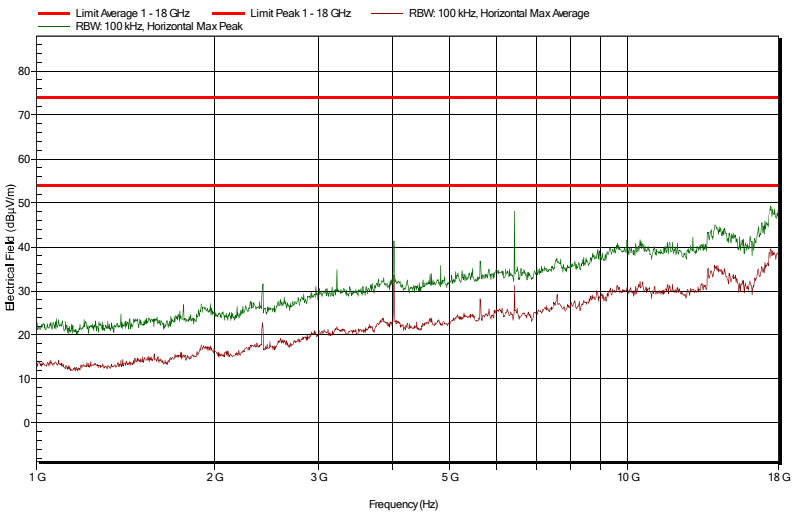
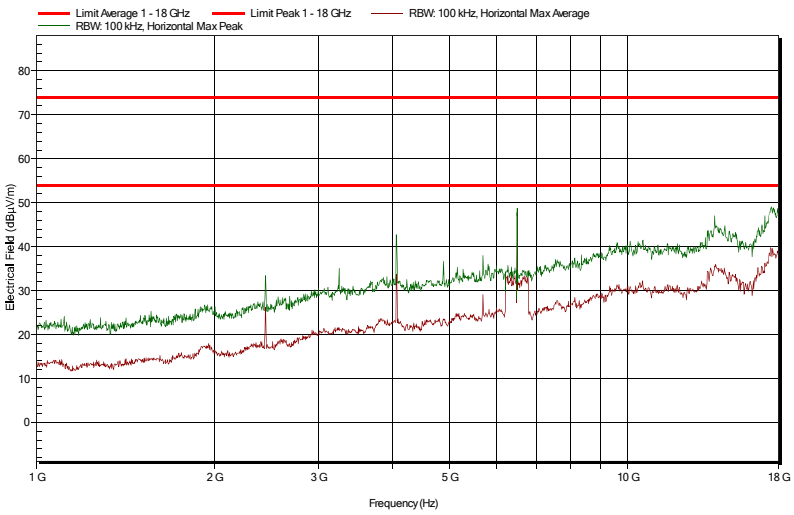
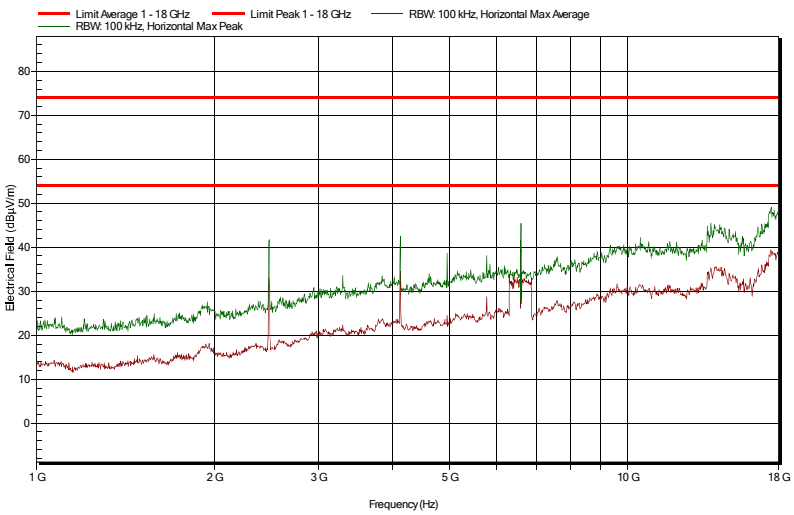
| Frequency (GHz) | Pol | Height | Average (dBµV/m) | Average Limit (dBµV/m) | Average margin (dB) |
|---|---|---|---|---|---|
| 4,061 | Vert | 2,5 m | 43,7 | 54 | -10,3 |

**Measured peaks Vertical 1 – 18 GHz High channel**

| Frequency (GHz) | Pol | Height | Average (dBµV/m) | Average Limit (dBµV/m) | Average margin (dB) |
|---|---|---|---|---|---|
| 4,119 | Vert | 1,5 m | 43 | 54 | -11,0 |

**1 GHz to 18 GHz**

**Horizontal polarization, 802.11b**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

**Measured peaks Horizontal 1 – 18 GHz Middle channel**

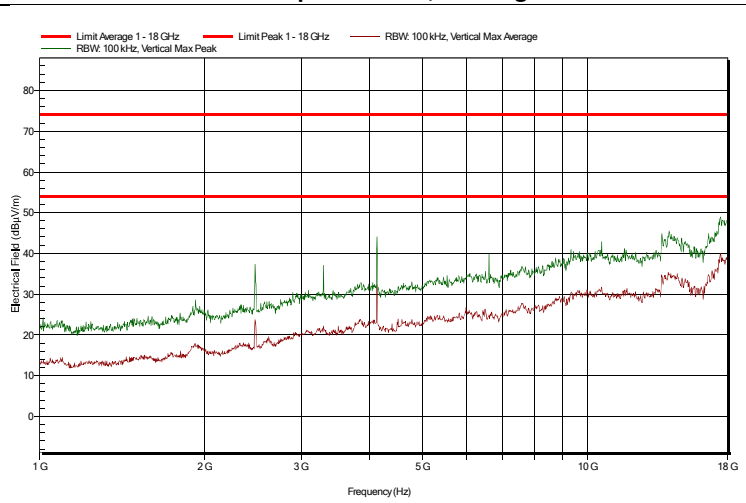
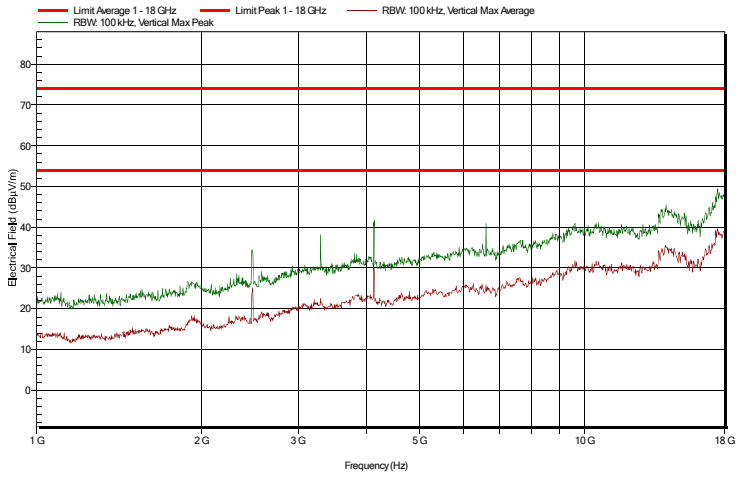
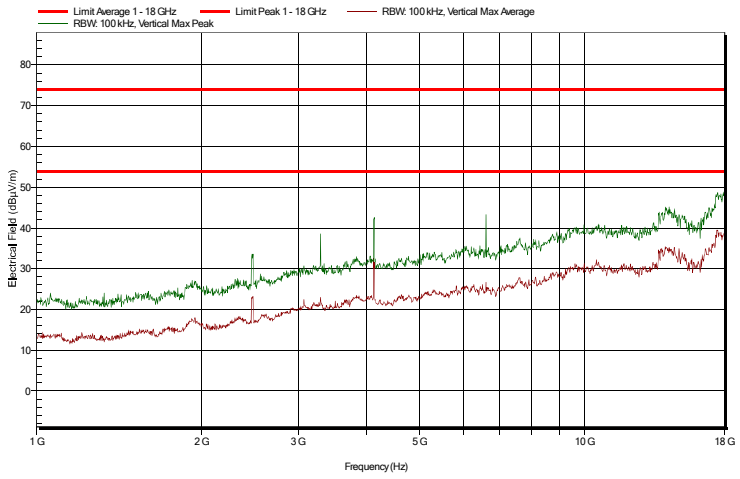
| Frequency (GHz) | Pol | Height | Average (dBµV/m) | Average Limit (dBµV/m) | Average margin (dB) |
|---|---|---|---|---|---|
| 6,499 | Hor | 1,5 m | 47 | 54 | -7,0 |

**Measured peaks Horizontal 1 – 18 GHz High channel**

| Frequency (GHz) | Pol | Height | Average (dBµV/m) | Average Limit (dBµV/m) | Average margin (dB) |
|---|---|---|---|---|---|
| 6,592 | Hor | 2 m | 38,2 | 54 | -15,8 |

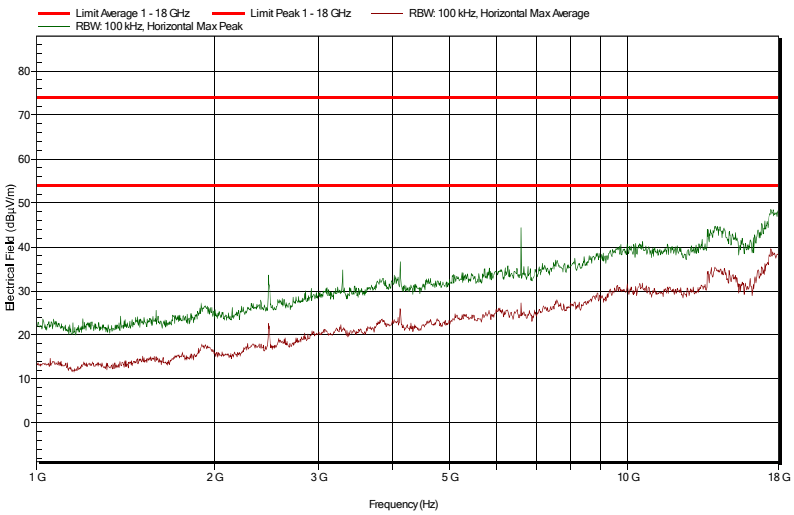
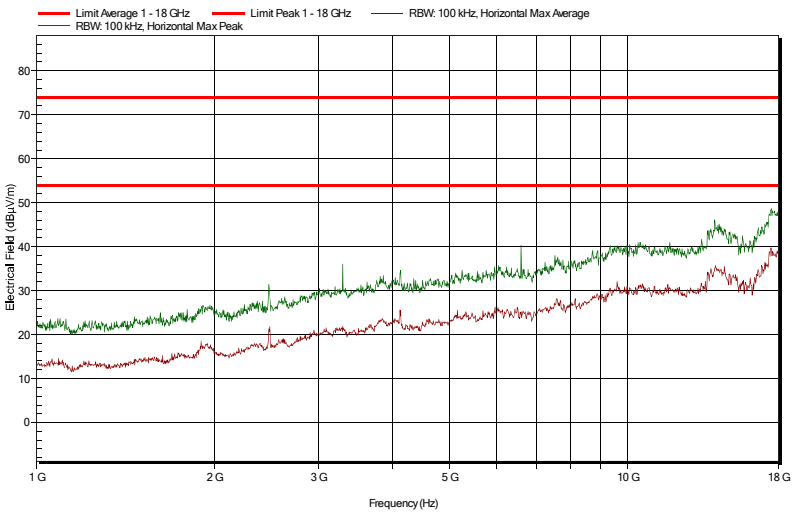
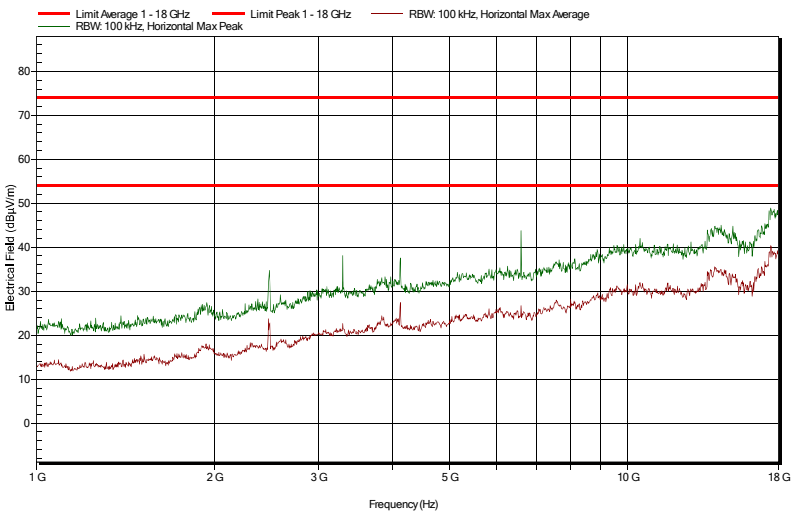
**1 GHz to 18 GHz**

**Vertical polarization, 802.11g**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

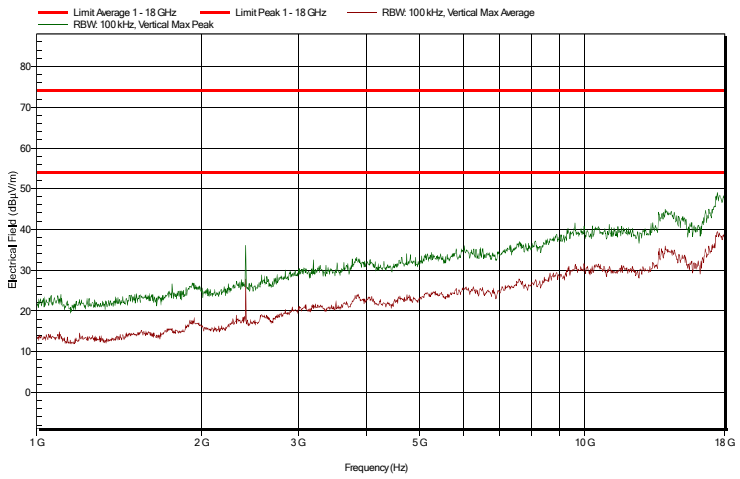
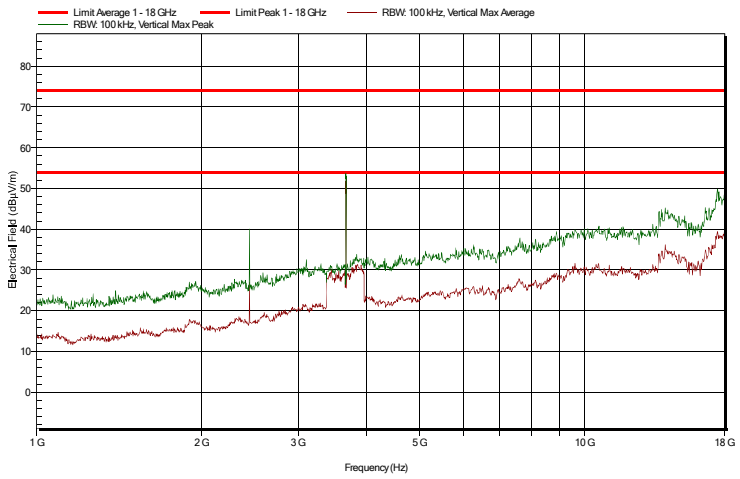
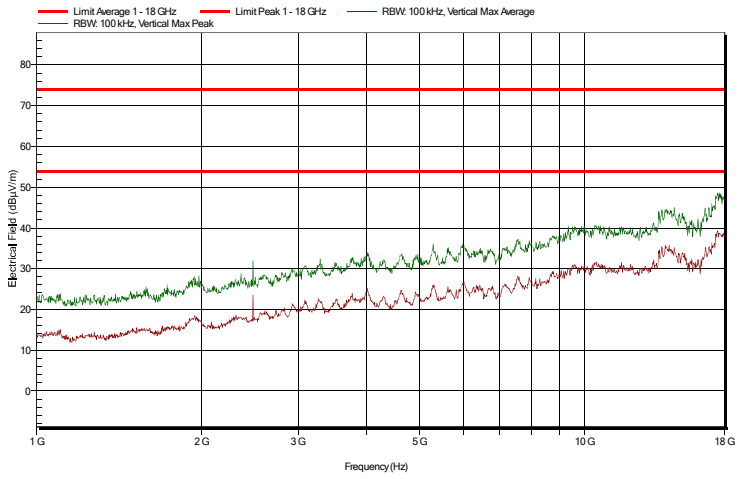
**1 GHz to 18 GHz**

**Horizontal polarization, 802.11g**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

**1 GHz to 18 GHz**

**Vertical polarization, 802.15.4**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

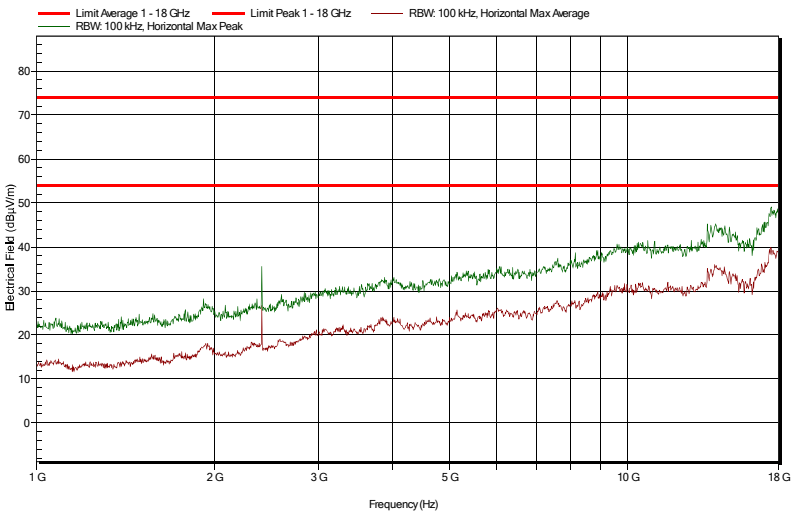
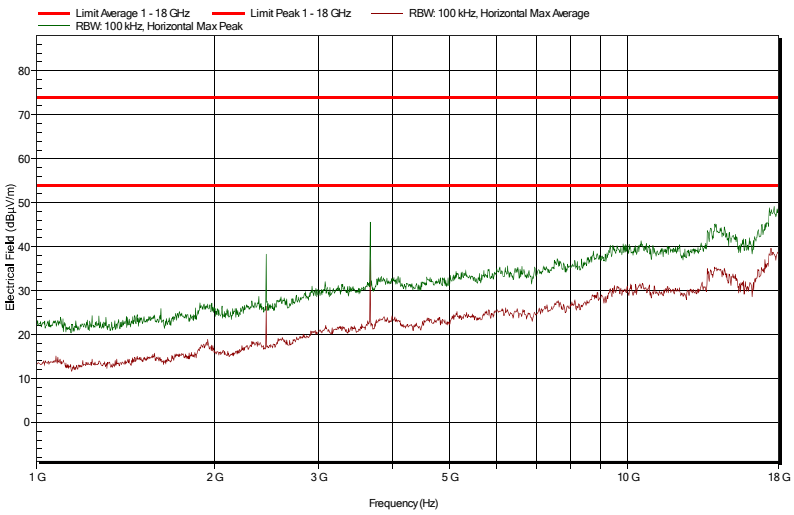
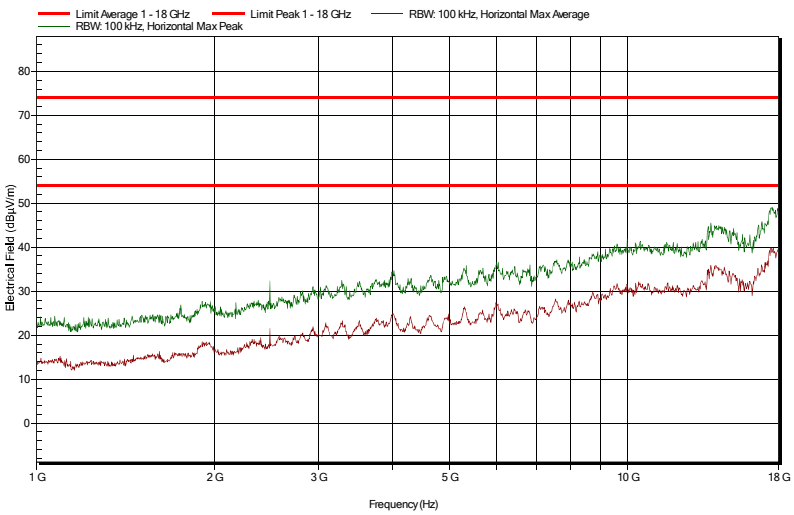


**Measured peaks Vertical 1 – 18 GHz Middle channel**

| Frequency (GHz) | Pol | Height | Average (dBµV/m) | Average Limit (dBµV/m) | Average margin (dB) |
|---|---|---|---|---|---|
| 3,667 | Vert | 2 m | 48,8 | 54 | -5,2 |

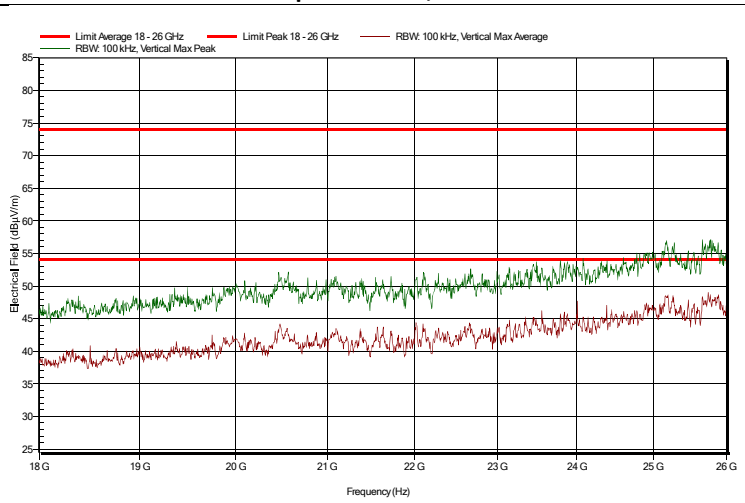
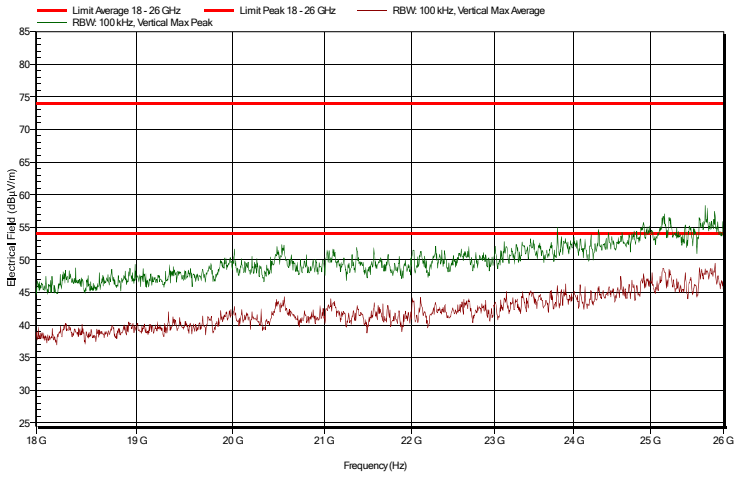
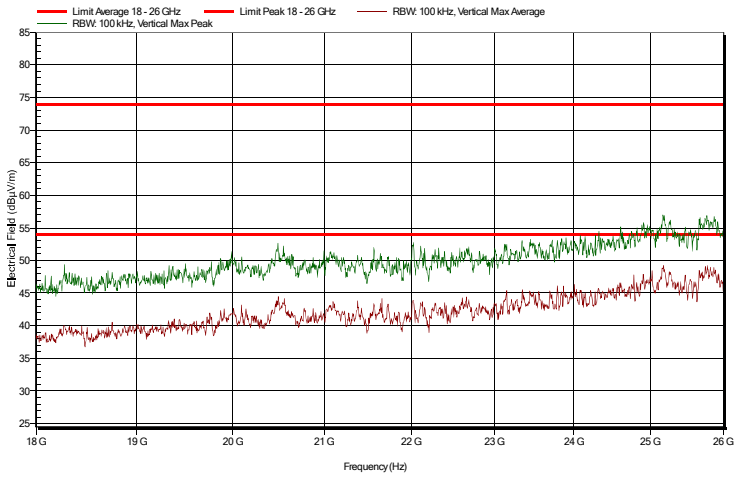
**1 GHz to 18 GHz**

**Horizontal polarization, 802.15.4**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

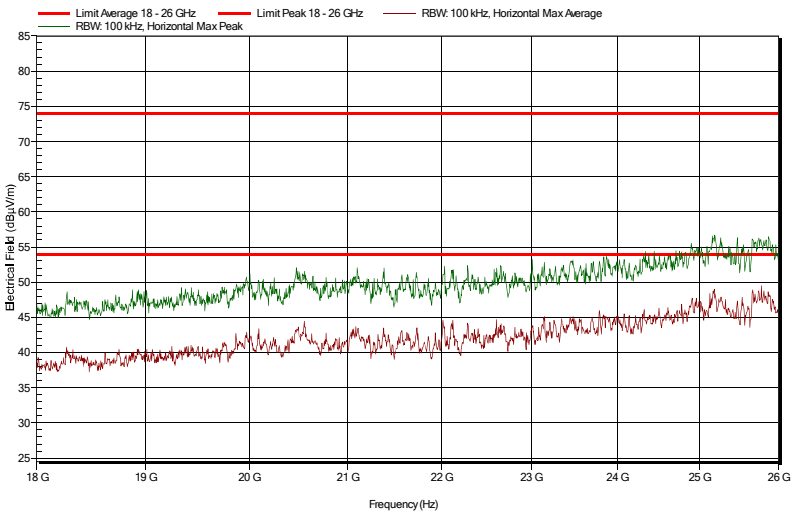
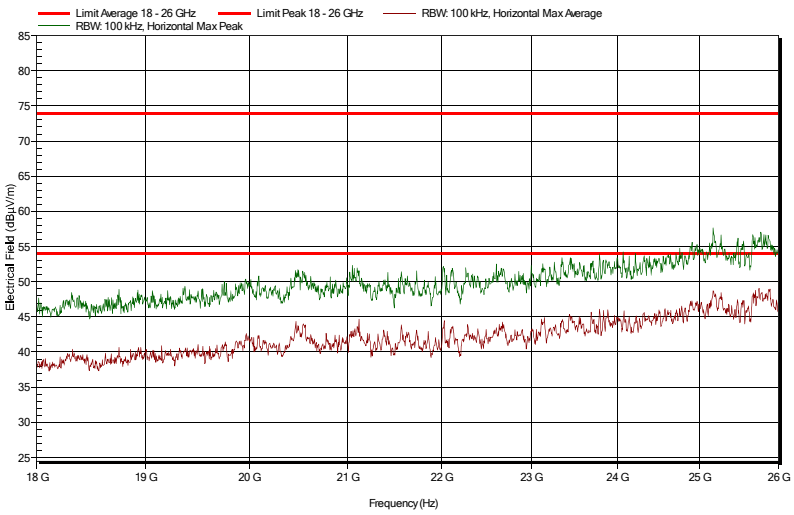
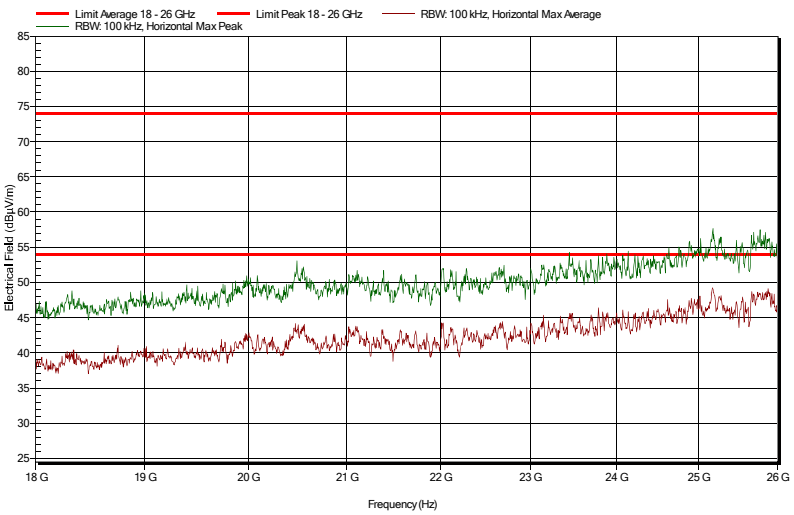
**18 GHz to 26 GHz**

**Vertical polarization, 802.11b**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

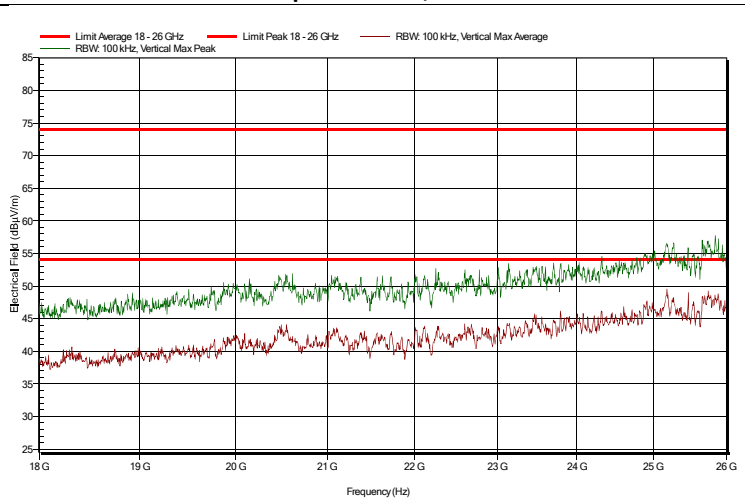
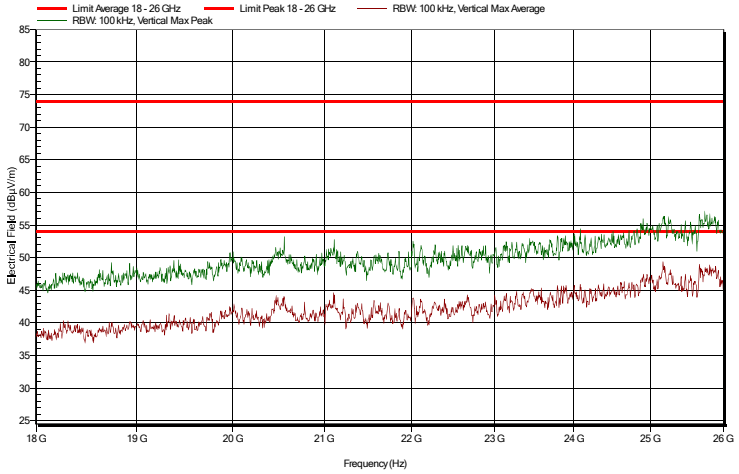
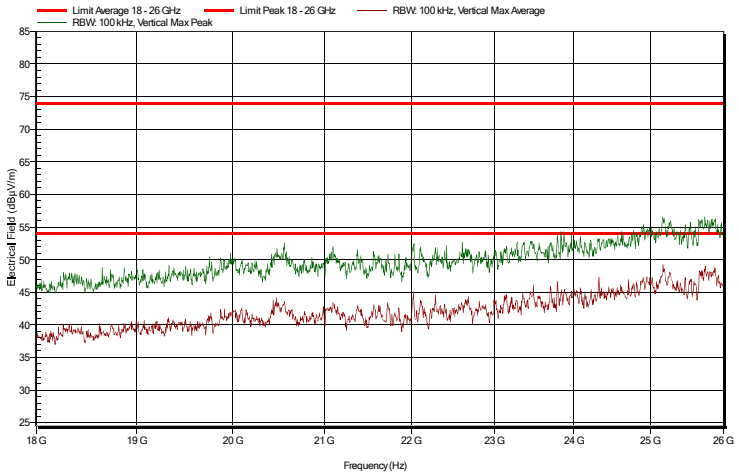
**18 GHz to 26 GHz**

**Horizontal polarization, 802.11b**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

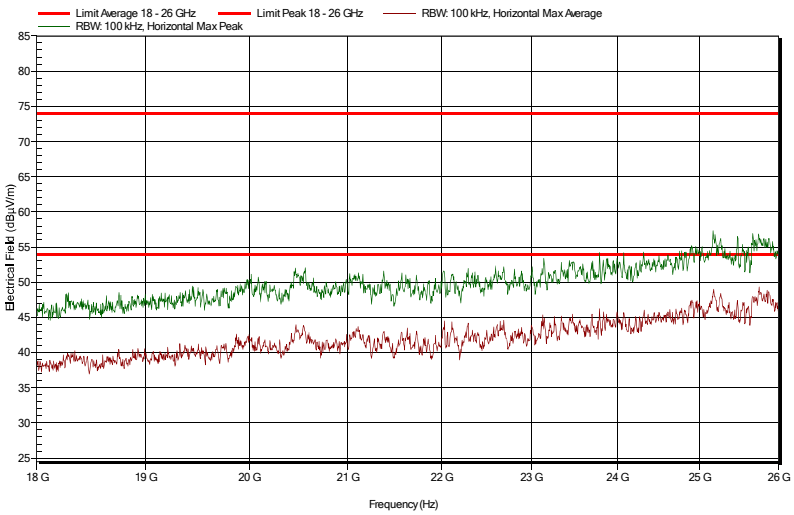
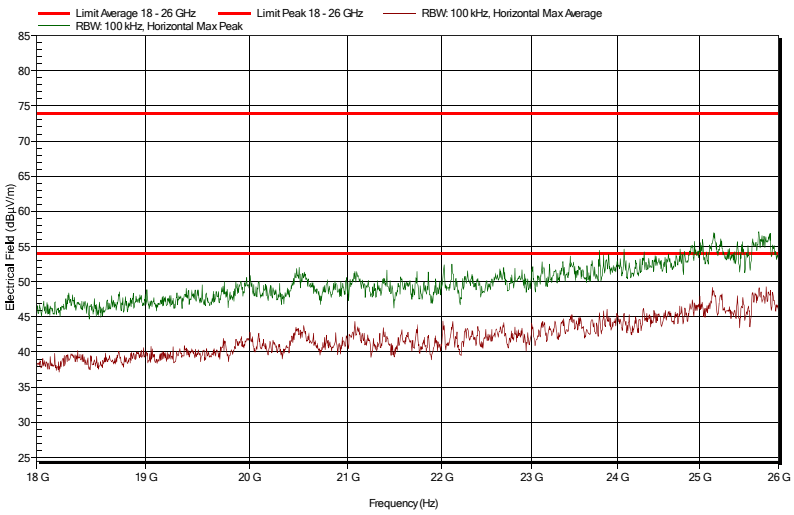
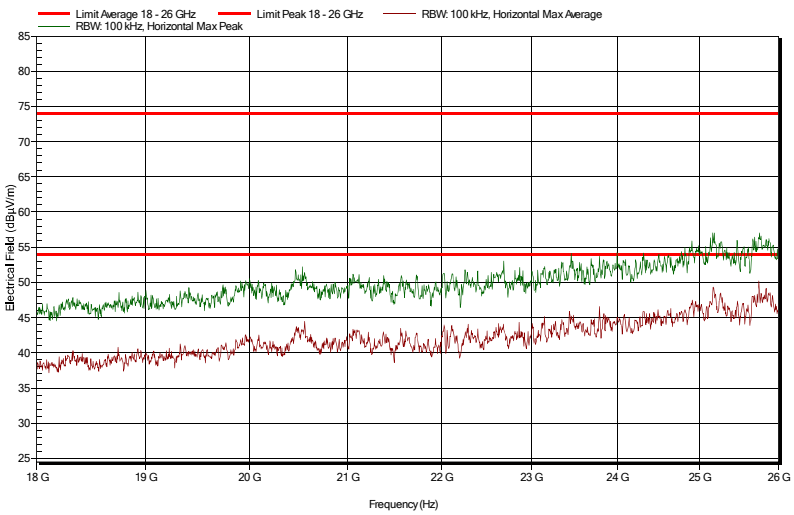
**18 GHz to 26 GHz**

**Vertical polarization, 802.15.4**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

**18 GHz to 26 GHz**

**Horizontal polarization, 802.15.4**

| | |
|---|---|
| **Low ch** |  |
| **Mid ch** |  |
| **High ch** |  |

### 3.6.7 Measurement uncertainty

**Measurement uncertainty Radiated emissions below 1 GHz**

| | |
|---|---|
| Horizontal polarization | |
| 30 – 200 MHz | 4.5 dB |
| 200 – 1000 MHz | 3.6 dB |
| Vertical polarization | |
| 30 – 200 MHz | 5.4 dB |
| 200 – 1000 MHz | 4.6 dB |

**Measurement uncertainty Radiated emissions above 1 GHz**

| | |
|---|---|
| 1000- 18000 MHZ | 5.7 dB |
| 18000 – 26000 MHZ | 3.9 dB |

## 3.7 Conducted Emissions

### 3.7.1 Limit

For equipment that is designed to be connected to the public utility (AC) power line, the RF voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

| Frequency of emission (MHz) | Conducted limit (dBµV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15–0.5 | 66 to 56* | 56 to 46* |
| 0.5–5 | 56 | 46 |
| 5–30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

### 3.7.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

### 3.7.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

### 3.7.4 Test procedure

According to ANSI C63.4: 2014, section 7.

### 3.7.5 Test results

See next page.

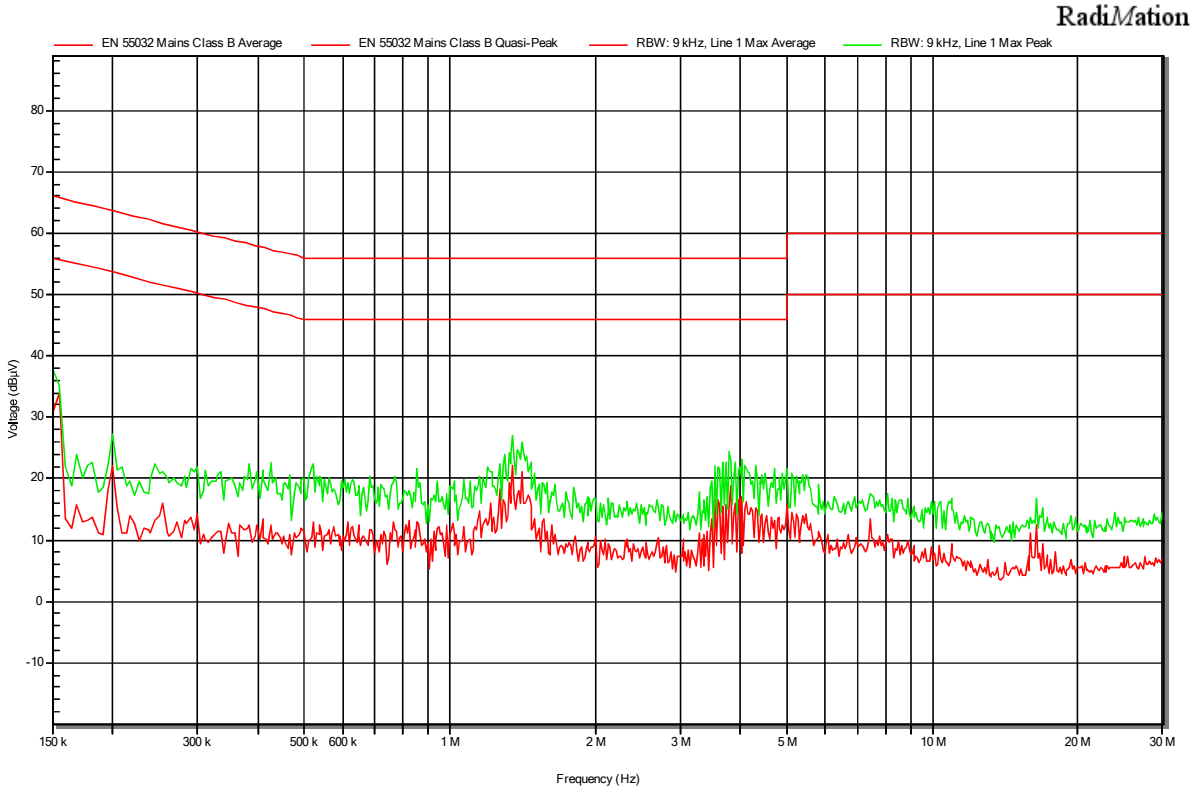
### 3.7.6 Measurement Uncertainty

Measurement uncertainty = + /- 3.6 dB.

### 3.7.7 Plots of the conducted emissions (0.15 – 30 MHz)

Test mode: Wlan active with data connection to boiler.
Justification: The test results below are measured on the AC power line of the boiler.
The power supply of the boiler, available during testing, was not able to run on 110 V AC 60 Hz. Therefore the measurements are performed with 230 V AC 60 Hz.
The difference between the 230V and 110V power supply of the boiler is a different transformer ratio. Given the test results, the different EMC coupling of the 110V AC transformer will not differ the compliance with the conducted limits.

**Line 230 Vac 60 Hz**



**Neutral 230 Vac 60 Hz**